Consulting Engineer

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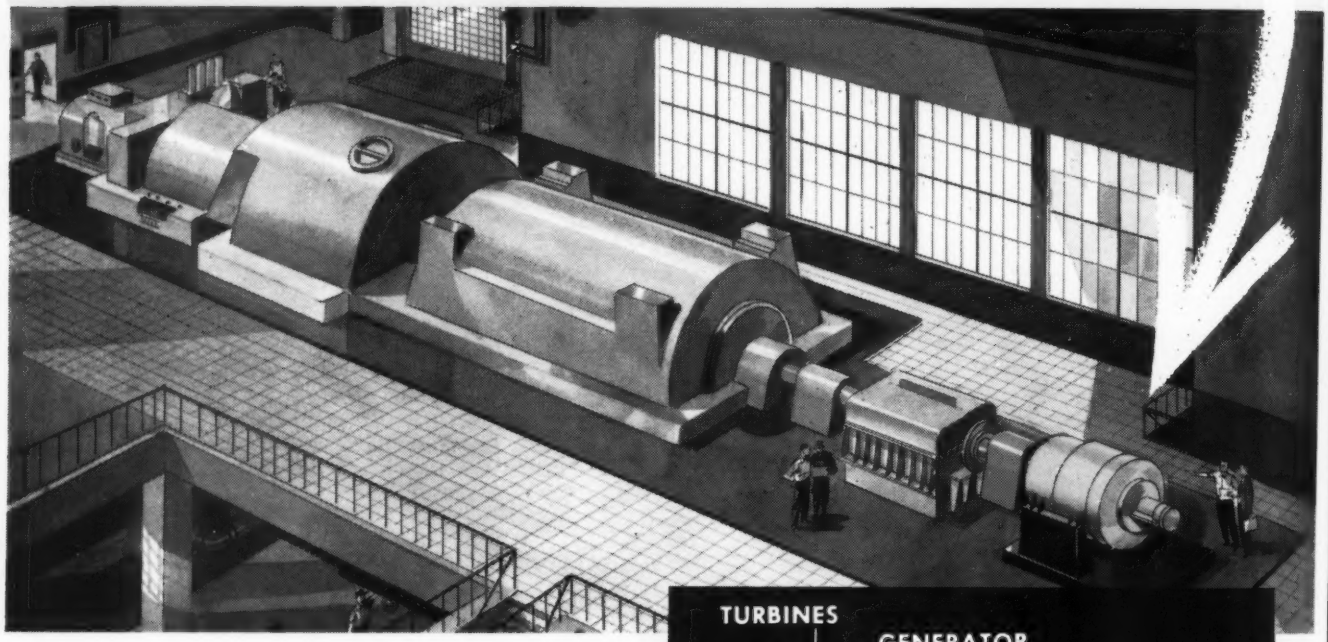
The Problems Are International

JULIAN S. TRITTON, President of the International Federation of Consulting Engineers (FIDIC), Chairman of the British Association of Consulting Engineers, and consultant in the London firm of Rendel, Palmer & Tritton, is standard-bearer for any cause that will help further the profession of consulting engineering. Whether the issue is engineering ethics, fee schedules, corporate advertising, or the activities of FIDIC, Julian Tritton makes it very clear, and

Continued on page 6

Byron Jackson makes history with World's Largest Boiler Feed Pump!



Byron Jackson is building the world's largest double case, high pressure boiler feed pump. According to BJ engineers, this pump will be at least twice as large as any boiler feed pump now in existence in the world. This huge unit—rated at 12,000 hp—will deliver 6,330 gallons per minute of feed water against a total dynamic head of 6,400 feet, or approximately 2,700 pounds per square inch at an operating speed of 3,510 rpm. It is being built for the Consolidated Edison Co. of New York, Inc.

A modification of the Byron Jackson-originated double case barrel type feed pump, the unit will consist of a cylindrical outer barrel and cover enclosing a horizontally-split inner volute case. The double volute design, together with back-to-back mounting of the impellers, provides for quick, uniform heating and reduces axial and radial thrust to a minimum.

UNIQUE DRIVE SYSTEM

For this BJ super pump, power company engineers are employing an altogether new concept of drive, the main generator steam turbine. Power is transmitted through an American Blower Corporation fluid drive coupling for variable speed operation to meet all load conditions.

To provide trouble-free operation, BJ engineers will incorporate packless type stuffingboxes with controlled leakage as well as a rotating element of rigid construction, limiting shaft sag to about one-third of the wear-surface clearances. Amazing as it may sound, this pump could be run dry.

ANOTHER BYRON JACKSON "FIRST"

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BJ

Byron Jackson

Division of Borg-Warner Corporation
P. O. Box 2017A, Terminal Annex
Los Angeles 54, California

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consulting engineer

May 1956

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The Consulting Engineer's Professional Magazine

Julian S. Tritton *—Starts on front cover*

in no uncertain terms, just where he stands.

He is against corporate advertising by an individual consulting engineering firm. On the other hand, he is for measures that will help educate the the general public to the work and responsibilities of the consultant. "Regarding fee schedules," says Tritton, "I think they are the best answer to competitive bidding. If the cost of a given project is fixed (by a fee schedule), you automatically eliminate the temptation that most frequently leads to violations of the code of ethics."

The fact that Julian Tritton became associated with one of England's oldest (founded in 1838) and best known consulting firms is not coincidence. His father, Sir Seymour Tritton, was for many years one of the senior partners of Rendel, Palmer & Tritton. Julian Tritton himself was elected a partner in 1929. The firm specializes in general civil engineering work and has been responsible for the design and construction supervision of docks, harbors, railways, roads, bridges, power stations, and similar projects in England and abroad.

Tritton has distinguished himself as partner in charge of his firm's Railway and Marine Department. He has advised many railways in foreign countries on the design and engineering of their equipment. He is also known for his work for harbor authorities on the design and construction of dredgers, tugs, and harbor craft. A highlight in professional recognition came when he was elected President of the Institution of Locomotive Engineers, in 1947 and 1951. He is also Honorary Secretary of the Diesel Engine Users' Association, and a member of the Newcomen Society of England in North America.

Since the war, Tritton has devoted an increasing amount of time to working for the betterment of the consulting profession. What are these interests?

"Speaking for the British Association of Consulting Engineers, there are many goals we want to work towards. Obviously, we want to increase the strength of our membership (presently about 900 members all of whom are partners or principals in their respective firms) and we want to win greater recognition for our profession. I particularly want to emphasize the latter point.

"Much of our work is done in foreign countries under the jurisdiction of men who, generally speaking, have little or no knowledge of the function of the consulting engineer. These officials, responsible for assigning engineering contracts, often consider consulting engineers in the same category as manufacturers or contractors. They do not understand the value of independent design and construction supervision. In fact, they frequently are not aware that our code of ethics forbids us to bid on consulting projects on a price basis. It is not to the advantage of the client, and bad business for us, when an assignment that should obviously be done by a consulting engineer is given to a contractor or a manufacturer.

"We believe that a sound program of education will put the consulting engineer into proper perspective with regard to the contractor and manufacturer. The British Association of Consulting Engineers has decided to use various publicity media to help educate key people, especially in the underdeveloped countries, to a better understanding of the responsibilities and functions of the independent consultant. We have distributed pamphlets, published by the Association, and we plan to engage in corporate advertising that will emphasize the role of the independent, British consulting engineer. We will not, however, promote the interests of any individual member of the Association, since this would be in direct violation of our ethical code.

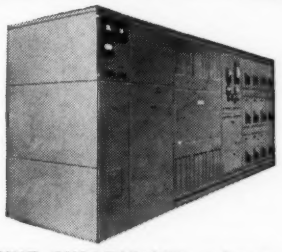
"Now, as far as the FIDIC (Federation Internationale des Ingenieurs Conseils) is concerned, we have to look after the interests of all the members in the Associations representing ten different countries. We try to establish uniform codes — like the recently negotiated understanding with the International Federation of Contractors regarding a general set of contract conditions for foreign construction jobs — and through meetings of the representatives of the Associations we exchange information and decide on how to deal with matters of common interest."

Mr. Tritton was in the U. S. the latter part of last year on a business trip. He attended the Diamond Jubilee Meeting of the ASME (of which he is a Member), in Chicago. At a luncheon of consulting engineers (sponsored by ASME), Tritton gave a brief talk outlining the work of FIDIC. He expressed the hope that American consultants would form an Association that could qualify for membership in FIDIC. American membership in FIDIC would bring American and European consultants into closer contact, greatly strengthen the Federation, and serve to unite consulting engineers on a world-wide basis.

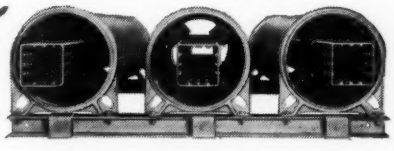
"As a good friend of the United States, I have long nourished the thought that our American colleagues in the forty-eight States would find common agreement on the need to establish an Association that could work towards furthering the goals of a uniform code of professional ethics and practices. You will find, as we have found, that it is easier to maintain the standards of our profession, win broad recognition, and stimulate the healthy growth of consulting engineering within an organized group.

"And when you Americans do form an organization that represents the interests of American consulting engineers, we will more than welcome your Association as a member of FIDIC. Together, we can pursue the aims and interests of the entire international community of consulting engineers." ▲▲

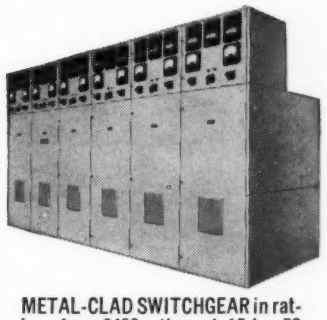
LOW VOLTAGE SWITCHGEAR through 600 v a-c, 250 v d-c, 15,000 through 150,000 amp interrupting, 6000 amp continuous.



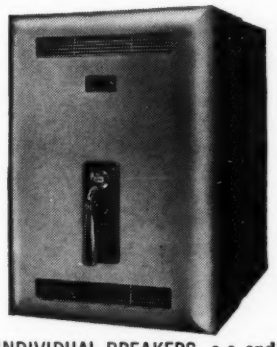
UNIT SUBSTATIONS—primary and secondary, indoor and outdoor construction—in all standard ratings, dry, askarel or oil transformers.



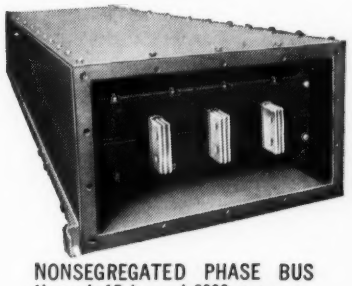
ISOLATED PHASE BUS through 138 kv and 10,000 amp.



METAL-CLAD SWITCHGEAR in ratings from 2400 v through 15 kv, 50 through 500 mva interrupting and 2000 amp continuous.



INDIVIDUAL BREAKERS, a-c and d-c, 15,000 through 150,000 amp interrupting, 6000 amp continuous.



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The Reader's Guide

As this issue reaches your desk, a group of your contemporaries, consulting engineers from the U.S., will be aboard a plane to Europe. We will land in London and spend the first week of our tour with British consulting engineers. We are having a luncheon meeting with their Association of Consulting Engineers and will visit the offices and projects of the members to discuss with them questions of mutual interest. This same program will be repeated, with variations, in Holland, Germany, Switzerland, and France.

We intend to repeat a trip of this type every year, visiting consulting engineers in various parts of the world. It is too early to schedule a definite itinerary for 1957, but preliminary plans are for a trip in May through England, Spain, Italy, and Greece. It is not too early for you to make your plans to join the group. Make a note of it now, and write us to put you on our preliminary reservations list.

The subject of this month's cover story is Julian S. Tritton, of Rendel, Palmer & Tritton, a consulting firm in London. The firm was founded in 1838. (Which is the oldest consulting firm in this country?) Tritton, himself, is currently President of the International Federation of Consulting Engineers, the organization that brings together all the ten National Associations of Consulting Engineers of Western Europe. A reading of this story will show that the problems faced by our consulting engineers are not local or regional in any sense. His comments on fee schedules, advertising, competitive bidding, and education of the public, touch upon ground familiar to every U.S. consultant. It should also be noted that Mr. Tritton, as President of the International Federation, invites U.S. consultants to join his group as soon as they have an organization that truly represents consulting engineers on a nation-wide basis. That time may not be too far off.

If you are wondering what to do with burned-out light bulbs, old razor blades, and extra copies of plans and specifications on now completed projects, we have a solution for one-third of your problem. Mail your old plans and specifications to us. Already we have a healthy file of specifications prepared by consulting engineers, and we use them in an educational campaign that should be to the advantage of the whole profession. Many manufacturers whose products are specified every day by consulting engineers do not know who it is that is responsible for writing the specifications. There are manufacturers, for example, who give the architect credit for specifying power plant equipment. Others are convinced that it is the contractor who draws the plans for all the mechanical equipment in a new school or hospital. The best way to bring these unbelievers around is to show them actual copies of specifications prepared by consultants. That we are doing. This educational process may take a long time, but eventually, the consulting engineer will be recognized as the potent purchasing influence he actually is.

Last month on this page we referred you to an article on the subject of composite construction by Gilbert Fish, of Seelye Stevenson Value & Knecht, which was described as appearing in that issue of CONSULTING ENGINEER. It did not. At the last minute we did some rearranging, and the Fish article was moved from April to May. There is no doubt about it this month. It is a good article—one worth waiting for an extra month.

Modern Central Stations Serving America

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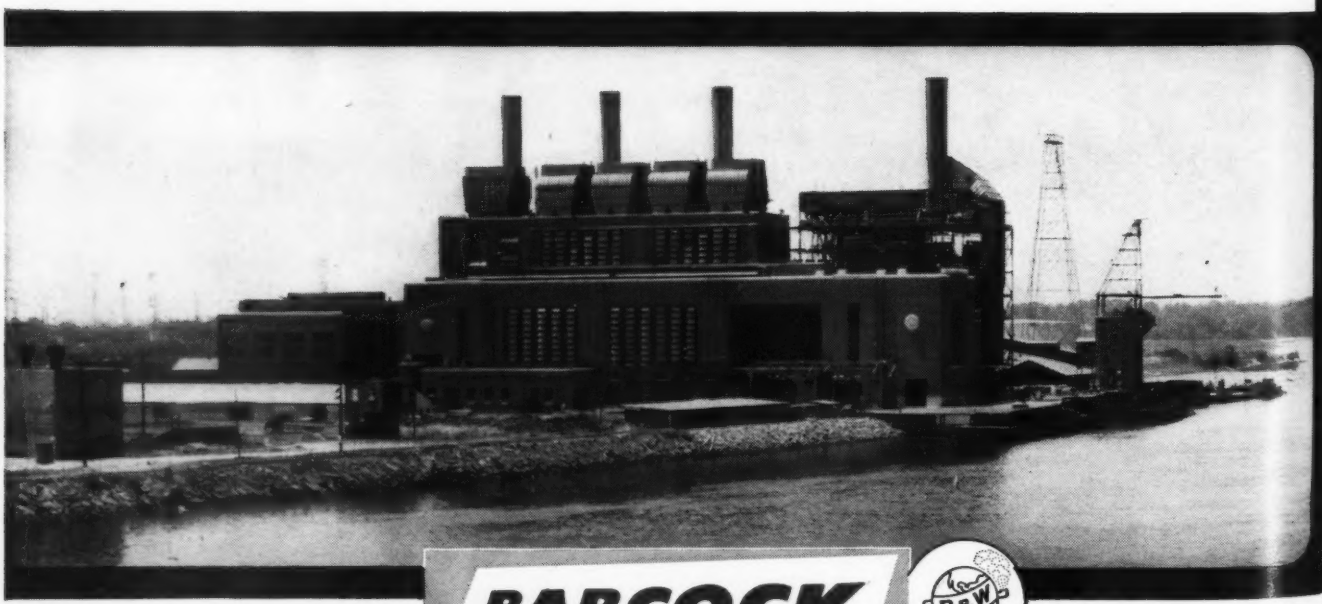
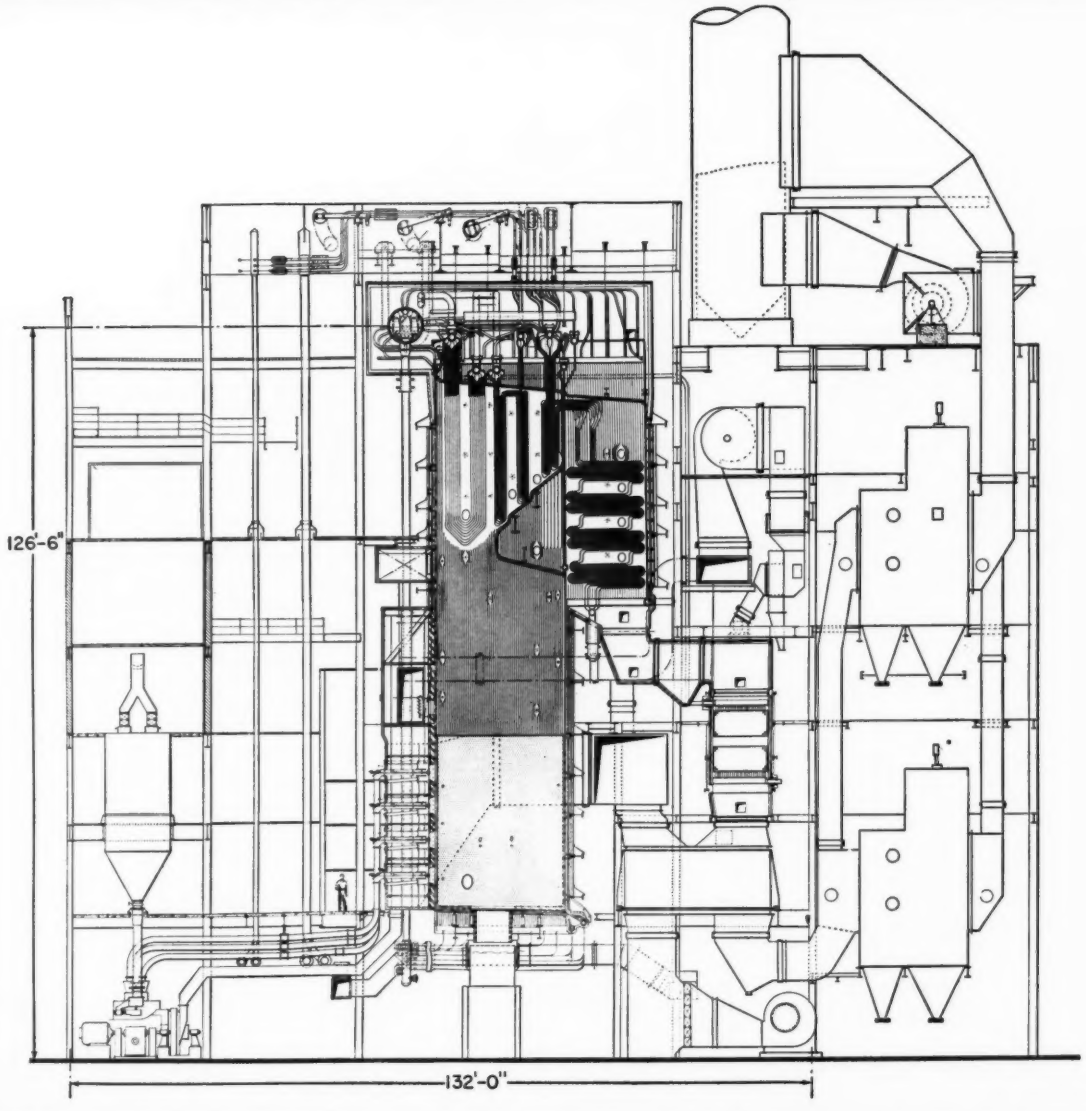
OF PUBLIC SERVICE ELECTRIC AND GAS COMPANY



BABCOCK & WILCOX

BOILER DIVISION



Supported by sound, practical engineering, Public Service Electric and Gas Company is engaged in a continuing, progressive policy of planning and over-all expansion to provide abundant, economical electricity to its large body of customers.

As part of this far-sighted program, Public Service Electric and Gas Company has installed a new, highly efficient 185,000 KW unit at its Burlington Generating Station. A B&W Radiant Boiler, generating over 1,225,000 pounds of steam per hour, contributes to the high level of performance of this new installation. The boiler is pulverized-coal-fired with provision for oil-firing, and is served by five B&W pulverizers. It is designed with divided furnace construction, gas recirculation, pressure firing and natural circulation. Unit design pressure is high—2700 psi, and the temperature is 1100 F at the superheater outlet with reheat to 1050 F.

Modern, efficient B&W steam generators, such as the latest unit at Burlington, are the results of long experience in designing, fabricating, erecting and servicing central station boilers of all types. Reinforcing this experience is an unending program of B&W research and development aimed intensively toward achieving still higher efficiency levels in the future.

The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y. G-753

Readers' Comment

"Our strength is as the strength of ten . . . "

Sir:

On Tuesday, April 17, there will be an exploratory meeting of consulting engineers in Oregon who have expressed interest in the formation of a statewide society of A.C.E. We know that the attendance will include some consulting engineers who do not receive your fine publication and who therefore are not familiar with the material on A.C.E. which was published in the January issue, 1956. . . .

You are to be complimented for the splendid job you have done with CONSULTING ENGINEER, in material selection, text, regular departments, and presentation. We have paid subscriptions to six technical journals but value your publication more than all the others. Each issue is handled more and read more than others combined. Much that we have learned from it has been incorporated in our practice.

Chet A. Kershaw, P.E.
Chet A. Kershaw and Associates
Portland, Ore

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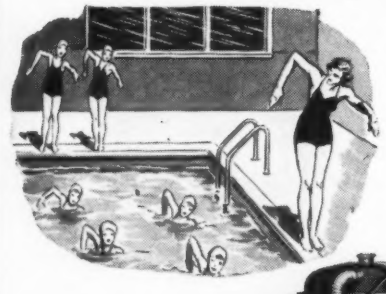
. . . vital safeguard when power is cut off by storm or accident



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Minnesota for Federation

Sir:

We are pleased to advise that the Minnesota Association of Consulting Engineers by letter ballot of its membership has overwhelmingly voted in favor of affiliation with a national organization of consulting engineers. . . .

We also wish to advise that our Extension Committee has been cooperative with consulting engineers in other states, looking forward to the formation of additional state associations and have provided them with salient literature and advice. We shall be glad to correspond with any or all consulting engineers who are interested in National unity.

We wish to thank you for the many helpful articles appearing in your (and our) magazine.

A. L. Sanford, Pres.
Minnesota Association of Consulting Engineers
Minneapolis, Minn.

Word from the South

Sir:

Some of us in Georgia have followed with interest the coverage CE has given the meeting of consulting engineers in St. Louis. We have also participated in your survey. I, for one, favor an association of consulting engineers in Georgia. . . .

Your publication is the most helpful and informative of any I receive.

R. Berl Elder, P. E.
Macon, Ga.

Something of a Shock

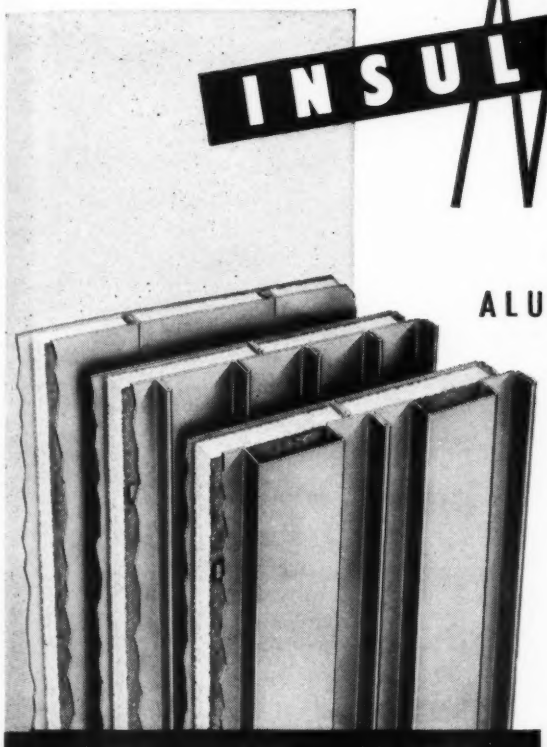
Sir:

Thanks so much for forwarding tear sheets from your March issue which included reference to the stud welded shear connectors used on the bridge at Ft. Pierre, S. D. The reference on page 72 to Seelye,

INSULATED METAL WALLS

for INDUSTRIAL and COMMERCIAL BUILDINGS

ALUMINUM, STAINLESS or GALVANIZED STEEL



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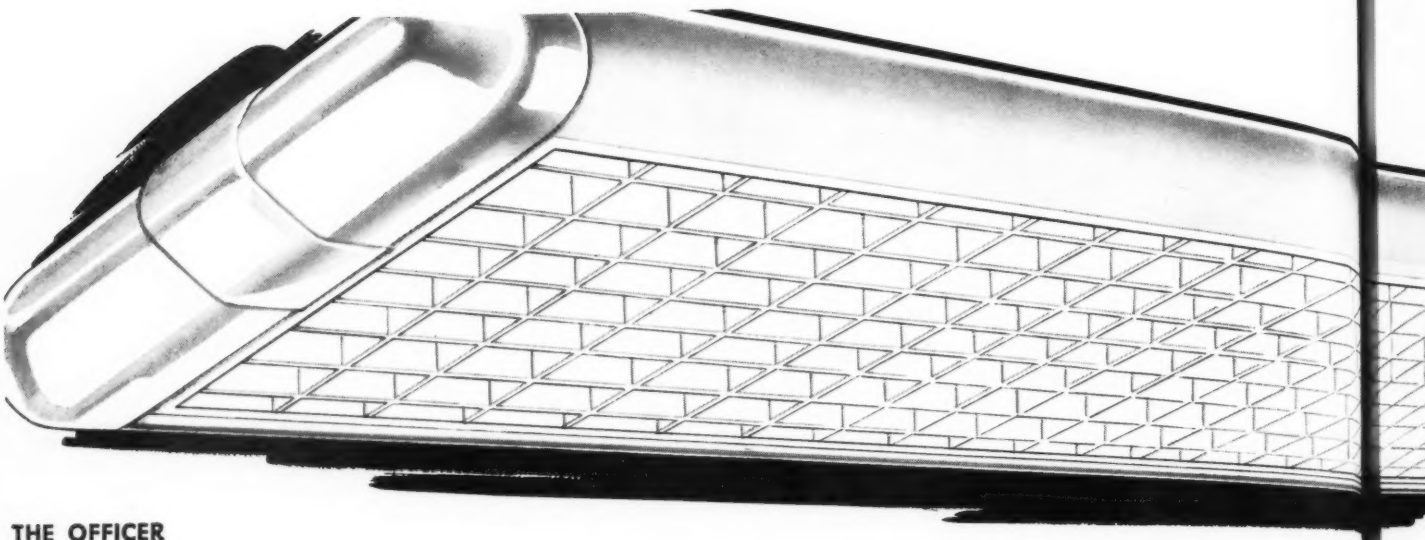
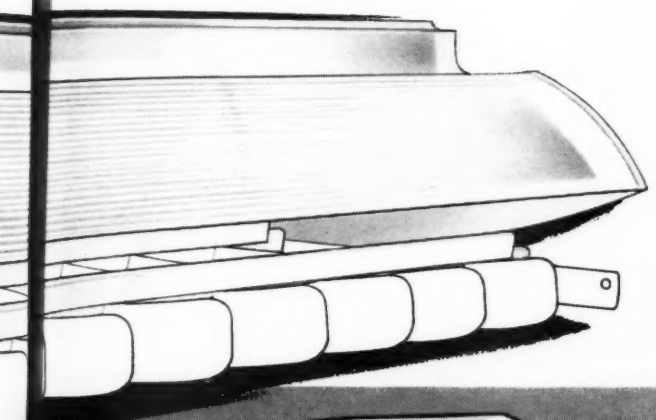


THE OFFICER

THE SCHOOLMASTER
THE DIFFUSER REFLECTOR
SUSTAINING MEMBER
RLM



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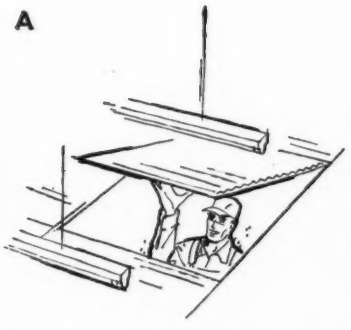

Low *Store* Lighting Installation Cost

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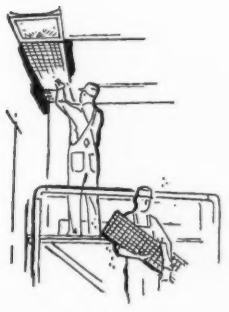

Low *Office* Lighting Installation Cost

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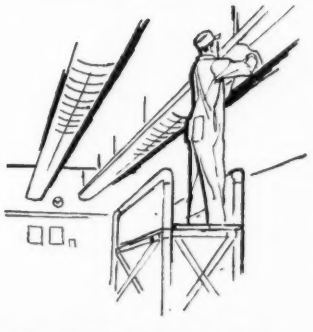

Low *School* Lighting Installation Cost

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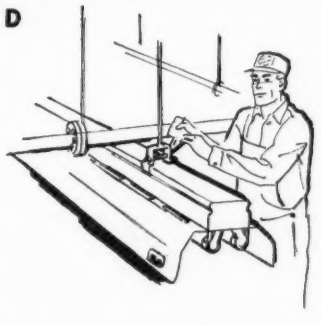

Low *Factory* Lighting Installation Cost

When all things are Considered, the Better Lighting choice is

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Simplicity features like these mean *Low Cost from Start to Finish*

A Simplicity is the Password! Precision-engineered channels and louvers of *Benjamin Luminous Systems* fit together without on-the-job changes.

B Architectural Treatments are a Breeze with clean-lined units like the *Officer*, featuring a variety of incandescent inserts to help achieve unique effects.

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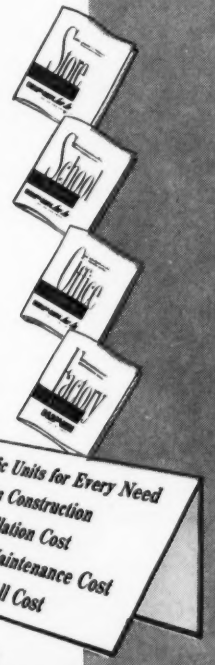
D "Slide" around Ceiling Obstacles! Easy-to-adjust sliding clamp hangers simplify mounting despite ceiling obstructions.

These and many other installation features help to get every Benjamin Lighting System off on the right foot. When you consider them, in addition to the other four major areas of Benjamin superiority, you will see why, "When *all* things are considered, the Better Lighting choice is Benjamin!"

Send for Free Lighting Booklets shown at right! Benjamin Electric Mfg. Co., Dept. CEN, Des Plaines, Ill.



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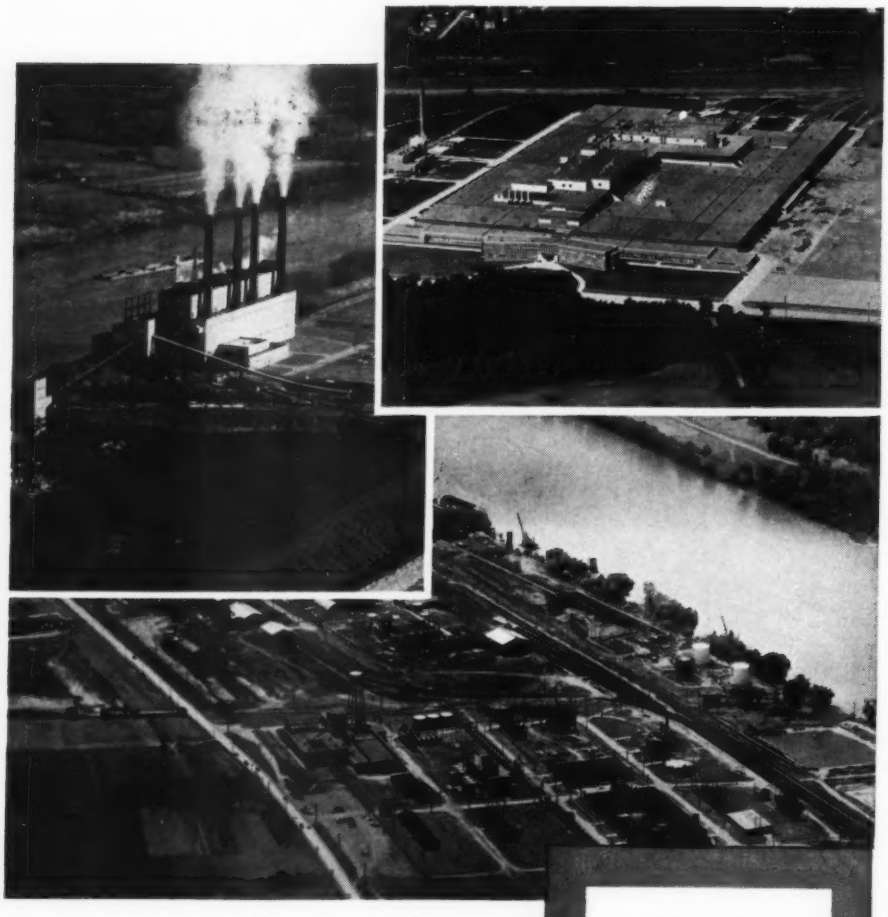

● *A new or expanded plant every 30 hours during the last 15 years!* That's the remarkable record of industry's confidence in B&O's Land of Big Opportunity. The reasons are clear. *This area* is the nation's *top market*, embracing about *half* its population—that means workers and customers. Natural advantages plus continual power-growth and availability of special raw materials provide a production-right scene for modern industrial operations.

B&O's *plant-location experience* assures industry executives *realistic* counsel on site selection. *Look where a site is production-right* . . . let B&O show you *on the ground*, or at your desk using modern airviews plus 3-dimensional color.

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the B&O

THIS SPECIAL STUDY ON REQUEST
From the B&O Railroad, Baltimore 1, Md.

BALTIMORE & OHIO RAILROAD

Constantly *doing things* —better!

Stevenson, Value and Knecht as consultants on the South Dakota bridge job came as something of a shock as they had nothing whatsoever to do with that project.

I cannot figure out how you got that impression but would appreciate your correcting it at your first opportunity unless Mr. Scurr of the South Dakota Highway Department or the people at Seelye, Stevenson prefer that you just let the matter ride without further mention.

Paul L. Eden
Eden and Associates
Cleveland 14, Ohio

Who's Who?

Sir:

Eden and Associates have invited my attention to an error in an article in your March issue in which on page 72 reference is made to the firm of Seelye, Stevenson, Value and Knecht as consultants for the bridge over the Bad River which has been designed and constructed by this department.

Since Mr. Eden communicated with you calling attention to this error on March 16, I had expected to hear from you prior to this time and might have been inclined to let the matter drop without requesting a correction. However, I now request that you make an adequate correction on this misinformation. Inasmuch as I have never heard of the firm of consultants mentioned. and they probably have never heard of the project in question, it is difficult to understand how such an inaccuracy could have occurred.

K. R. Scurr
Bridge Engineer
State of South Dakota
Department of Highways

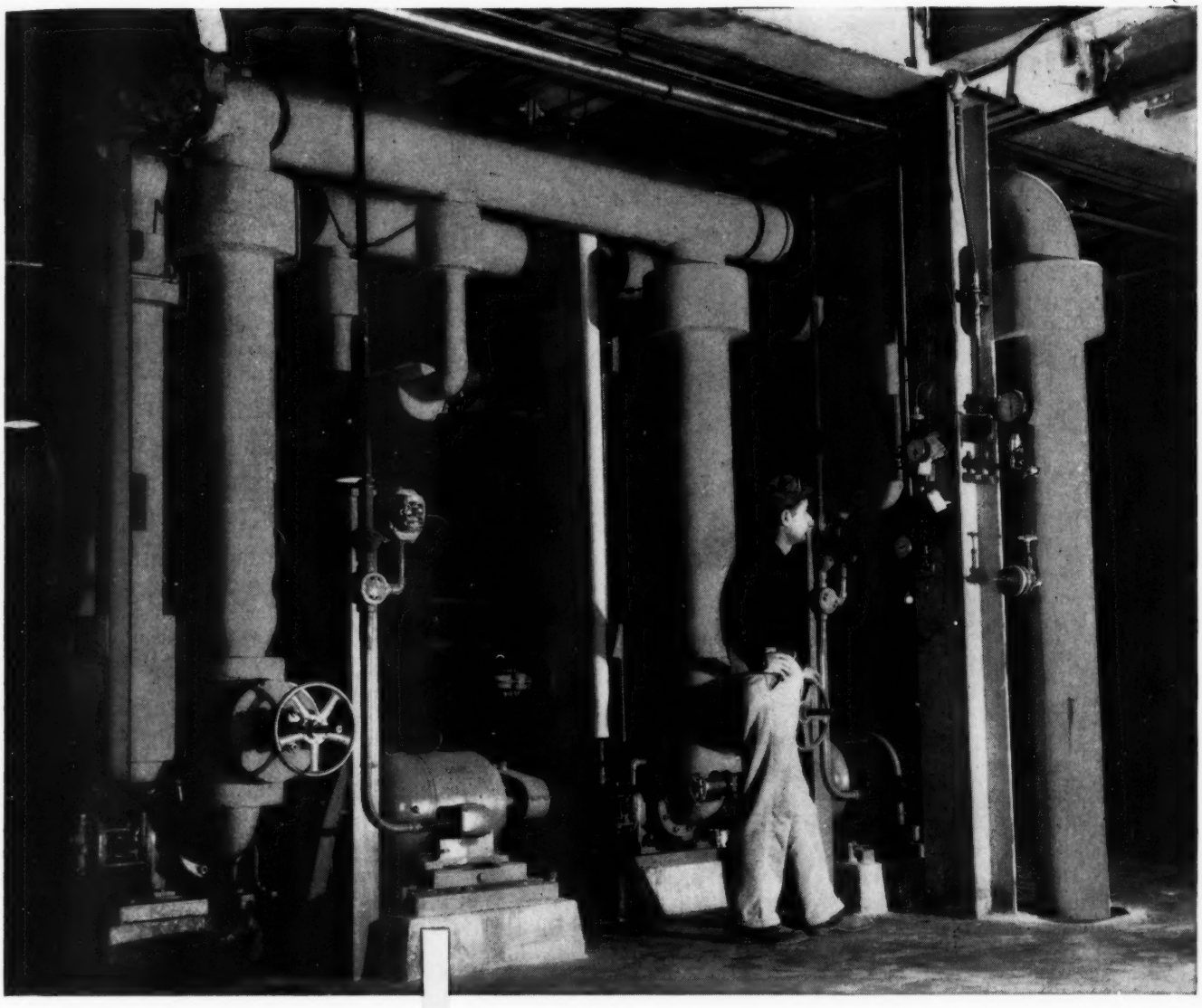
Now Noted

Sir:

We were surprised to discover on page 72 of the March issue that we had been given credit as consultants for the Bad River Bridge at Fort Pierre, South Dakota.

We have been in correspondence with you recently on the use of stud welded shear connectors, and assume that some member of your staff included us in this job. While we have done extensive work on the use of stud welded shear connectors, we had nothing whatsoever to do with the design of this Fort Pierre bridge.

We would appreciate your making a note of this in an early issue as we do not want to receive credit for



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Plant piping takes on this trim, tailored look — and in record time — when you insulate with G-B Snap*On, the one-piece molded pipe insulation of fine glass fibers. From ¾" through 33" IPS and in 3' and 6' sections depending on pipe size. With just a pocket knife and a stock of Snap*On in nesting sizes, *anyone* can make easy work of the once-tedious job of insulating bends, valves and other fittings.

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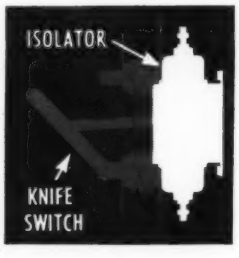
Straight line action makes ISOLATOR the most efficient disconnect switch

Bill Dres, 3E Regional Sales Manager, points out the visible air gap—an important ISOLATOR safety feature

ISOLATORS save on cubicle construction and floor space because they take about ⅓ the space required by equally rated knife switches. They also weigh less and as all elements, including poles, are mounted and aligned on a rigid frame at 3E, they are simple to install. When the ISOLATOR moves from closed to open position its current carrying parts move in a straight line and telescope as contact is made. The parts are enclosed in insulated bushings which also telescope, shielding live parts and eliminating flash barriers.



ISOLATORS are safer . . . in the open position, the gap between the bushings is easily visible. Yet the opening is narrow enough to lessen the chance of accidental contact with the live parts. The exposed studs at top and bottom are arranged for easy taping. When your men work in cubicles equipped with ISOLATORS they will be safe from live part hazards.

This switching center, designed and built entirely by 3E, shows how ISOLATORS make a compact, functional and handsome unit. These are 5 KV, 200 ampere ISOLATORS. The ISOLATOR is also ideal in combination with potheads; any number of arrangements are possible and the units are easily interchanged if necessary. 3E makes many kinds of indoor and outdoor switches, and has a staff of engineers experienced in designing complete units for all types of special applications.

On your next switching problem, See 3E for recommendations and estimates.

ELECTRICAL ENGINEERS EQUIPMENT CO. Melrose Park, Illinois

the fine work of Mr. E. J. Palmer, Mr. S. Miller, and Mr. K. R. Scurr.

Philip P. Page, Jr.
Seelye, Stevenson, Value & Knecht
New York, N.Y.

Report Writing Aid

Sir:

May we have at least one reprint of the very excellent article entitled "Reports Your Clients Want to Read." If the additional copies are available, we would like to place them in the hands of at least six project leaders for their guidance in preparing reports.

Wm. B. Spurrier
Manager of Projects, Steel Div.
Giffels & Vallet, Inc.
L. Rossetti
Detroit, Mich.

Invitation from Italy

Sir:

As subscribers to your magazine we have learned about the proposed trip of American consulting engineers to Europe next May.

We would like to know as soon as you have completed your program whether you also plan to arrange for a visit to Italy of your group, and eventually the composition of this group.

We believe that our company, together with C.T.I.P. (Compagnia Tecnica Italiana Petroli, Rome) are the two largest independent, Italian consulting engineers companies, and we may therefore be interested either to meet your group or to arrange for visits to Italian plants.

Roberto Rocca, Vice Pres.
"Techint"
Compagnia Tecnica Internazionale
Milano, Italy

Re-organizing Functional Group

Sir:

Referring to your article "What the Survey Said" and the paragraph on page 57, which indicates the possibility of any interested Engineering Society or Association using the returns, may I ask that you send for my scrutinization, the returns from the consulting engineers in Ohio.

As you may well understand, the Ohio Society of Professional Engineers is reconsidering the Private Practice Functional Group setup, and while we intend to put out a questionnaire of our own, I would like to review the information now in your fiile.

We will be happy to co-operate with you on any information we may obtain in the attempt to re-organize our Functional Group.

Alfred H. Samborne, P.E.
President Elect, O.S.P.E.

Lunkenheimer Announces

ANOTHER GREAT NEW LQ600 VALVE

200 Lb. S.P.! 400 Lb. W.O.G.!

Lunkenheimer's famous LQ600, the Bronze Globe Valve that set a new high standard of performance on 150 lb. service, is now available for 200 lb. S.P., 400 lb. W.O.G. applications. The new line features the same long-wearing flat seats and discs made of Brinalloy®, plus a body and bonnet of Lunkenheimer's amazingly strong S-1 Bronze for higher-pressure service. Install this great new LQ600 Valve on your 200-lb. pressure lines—including all your toughest services—and compare its performance with other valves. It's built to eliminate maintenance costs because there is no replacement of seats and discs—they are patented Brinalloy, brazed in to stay, harder all the way through and more resistant to wear and corrosion than 500 Brinell Stainless Steel and far exceeding the wear resistance of 1000 Brinell case-hardened Stainless Steel.

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GOOD PROGRESS is being made in the formation of a National Federation of Consulting Engineers. The ten state and regional Associations of Consulting Engineers chose well when they selected the men for their Steering Committee. John Pryke, Tom Roche, Pecos Calahan, and Barney Dornblatt have produced an excellent draft of a National Constitution and Bylaws, and copies have been sent to all of the members of the ten Founder Associations. At the moment, the members of these associations are studying the draft, and some of the associations already have approved it in principle and are compiling lists of suggested changes to be presented to the Steering Committee.

If minor changes and compromises can be worked out by the Committee, there will be a meeting of representatives of the associations, in Tulsa, in July. Presumably, the Constitution and Bylaws, in revised form, will be adopted, and a Board of Directors will be elected.

In the meanwhile, officers and members of the several State Associations of Consulting Engineers have not been sitting on their hands. At last report, there were 12 functioning associations in 11 states. Soon this will be reduced to 11 associations in the same number of states, for the Upstate (New York) Association and the New York (City) Association have decided to become one. In three additional states, associations are in the later stages of development—about ready to function—while associations in 18 more states are in the embryo stage. All of this has been accomplished by the hard work of members of the various state and regional associations now in existence. Without doubt, most of the credit goes to the Minnesota Association for their missionary work. It seems safe to say that by the date of the organizational meeting in Tulsa, there will be at least ten additional associations ready to apply to the Founder Associations for membership in the Federation.

We have watched the development of this Federation idea from its inception. And we admit that our watching has not always been without qualms. Most disturbing has been the feeling by some engineers high in the National Society of Professional Engineers that any effort to form an association with membership limited to engineers in private practice would be a weakening of the efforts of the National Society to bring all engineers together into one group. We understand that feeling and recognize the advantages of the Functional Group concept, but the disadvantages outweigh the advantages in the opinion of most consulting engineers.

As we see it, all registered engineers should belong to NSPE. However, the business problems of engineers in private practice are so different from those of employee engineers that there is a need in each state for a separate organization with membership limited to private practitioners. This should in no way weaken the excellent work of NSPE in promoting the professional development of all engineers. It is our hope that in a short time the new Federation and the National Society of Professional Engineers will find that their efforts mesh rather than clash. This proved true following the formation of the Consulting Engineers Association of Oklahoma, and it can happen on a national scale. If the National Society will continue to work for the good of consulting engineers as part of the whole profession, they can feel sure that consultants will continue to work for and with that group.

The other organization with a certain community of interest with the Federation is the American Institute of Consulting Engineers. Just a few days ago the Institute turned down an invitation to become one of the Founder Associations of the new Federation. We think they were wise in their decision—particularly since their turndown was accompanied with a sincere offer to cooperate.

We think the Institute was wise in their decision because their purpose and approach are different from those of the state and regional associations making up the Federation. There is about the Institute something of an honorary flavor. Their current membership is made up of engineers who have particularly distinguished themselves by their engineering work. To try to combine this honorary concept with the business aspect of the Federation would not be good. We would rather see the Federation as a down-to-earth "trade" association dealing with the business problems of consultants, while the Institute continues to emphasize their "distinguished accomplishments" requirement for membership. If this is done there could be a meshing of objectives. The American Institute of Consulting Engineers is to be congratulated on their attitude of cooperation.

WHERE SAFETY IS NO ACCIDENT

The confidence of engineers in FLEXITALLIC Spiral-Wound Gaskets is based on performance. Flexitallic has justified that confidence for more than 40 years by:

—a continual search for new and better gasket materials

—maintaining standards of engineering and design that give complete assurance of a work-proved seal

—making of gaskets on precision winding machines designed by our own engineers.

In nearly every industry, engineers look to Flexitallic for leadership in safety. As the service becomes more hazardous — in aviation, atomic research, power plants, process industries, and aboard ship—the need for Flexitallic Gaskets becomes more urgent.

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Flexitallic Gaskets are at highest efficiency when bolted up cold at a predetermined load. For all pressure/temperature ranges from vacuum to 10,000 lbs., from extreme sub-zero to 2000°F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285".

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ATOMS IN ACTION

FOUR U. S. COMPANIES have contracted to sell research reactors to foreign buyers under the U. S. bilateral agreements program. Babcock & Wilcox Co. will build a scaled-up version of the University of Michigan swimming pool reactor for the Brazilian Atomic Energy Commission, at the University of Sao Paulo. Capacity will be up to 5000 kw, the highest rated unit of this type yet announced. The Junta de Energia Nuclear (the AEC of Spain) is purchasing a 3000 kw (heat) swimming pool unit from General Electric for installation near Madrid. North American Aviation, Inc. has a $250,000 contract for a 50 kw water boiler reactor from the Atomic Energy Research Institute of Japan. Similar to the unit at Armour Research Foundation, this reactor will be located near Tokyo. The Italian National Committee for Nuclear Research has agreed to purchase a 5000 kw (heat) heavy water moderated reactor from ACF Industries, Inc. It will resemble the CP-5 reactor ACF is designing for MIT.

WESTINGHOUSE ELECTRIC has changed the proposed site of its $6.5 million materials test reactor to an 800 acre site near Waltz Mill, 29 miles southeast of downtown Pittsburgh. This location is closer to the company's other atomic power activities, in the Pittsburgh area and in Cheswick. Original site was in Blairsville.

RECENT STUDIES of the power reactor to be built near Chicago by GE for Commonwealth Edison and Nuclear Power Group indicate that the plant may have an output considerably better than the 180,000 kw originally figured on. Completion is scheduled for mid-1960. NPG also has a group working in cooperation with Babcock and Wilcox on an intensive study of an aqueous homogeneous reactor.

TWO SHORT COURSES in the atomic energy field will be offered by the University of California at Berkeley this summer. "Nuclear Engineering Short Course," running from July 2 to August 31, is designed for those with technical responsibility. The one-week "Nuclear Engineering Survey," from July 9 to 14, is open to those with executive responsibility. Write to K. L. Downes, executive secretary, Engineering Extension Nuclear Energy Programs, Room 100, Building T-11, U. of C., Berkeley 4, Calif.

WILLARD LIBBY, AEC Commissioner, called on the chemical industry to participate more actively in the atomic energy program in a speech at the American Power Conference. He pointed out that the industry might consider use of by-products of the atomic reactor, suggesting the possibility of using the heat generated by a power reactor for chemical processing, thus combining a chemical business with a power station.

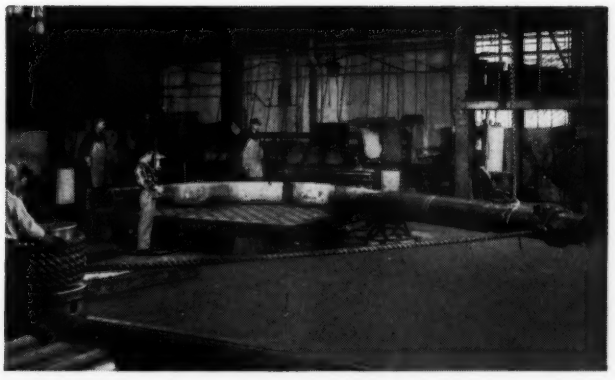
AGREEMENT seems to be near on a draft statute for the proposed International Atomic Energy Agency, a group to allocate and control a stockpile of nuclear fuel intended for peaceful purposes. Representatives of the 12 nations working on the statute, including the U. S. and the Soviet Union, have reached substantial agreement on major provisions. Chief stumbling block is an acceptable compromise on composition of the Board of Governors. U. S. delegate James J. Wadsworth stated that the completed draft statute will require ratification either by the Senate or a joint Senate-House resolution. The general ratification conference of 86 nations (all UN and specialized agency member nations) will probably take place sometime this fall.

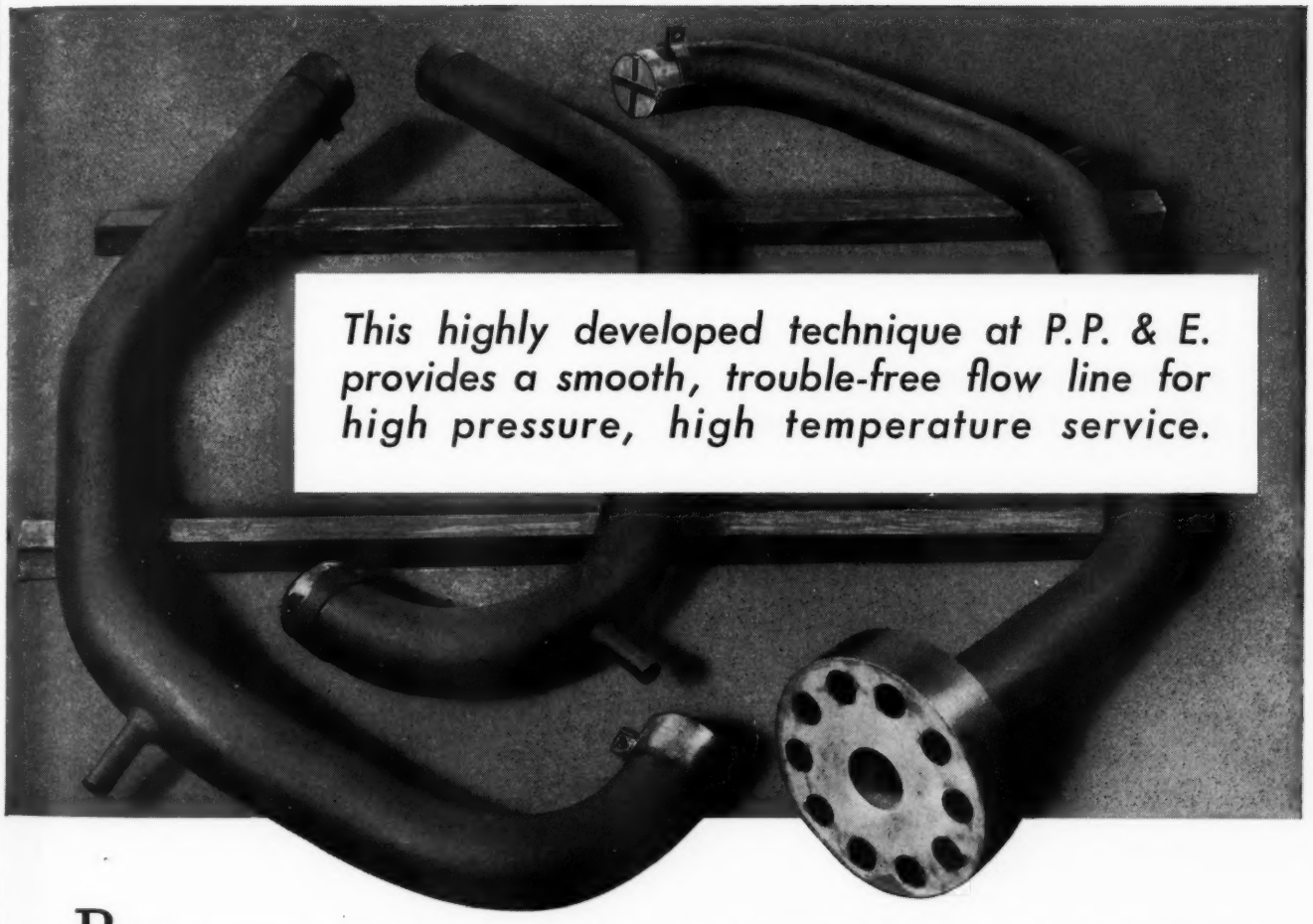
THAT THIRD PARTY LIABILITY coverage now available from the insurance industry will not be adequate to meet the needs of operators and builders of reactors was the consensus of an advisory seminar conducted by the Joint Congressional Committee on Atomic Energy and including AEC staff members, representatives of reactor manufacturers and operators, component suppliers, insurance companies, and the legal profession. Recommended solution to the problem of adequate insurance was some form of federal legislation. Two bills are now before the Joint Committee. Representative Mel Price's bill provides for federal indemnification for ten years. The bill by Representative Sterling Cole would add a new section to the 1954 Act, making the licensee not liable for damages more than twice the original capital cost of the facility. Big questions are: if the Government participates, how should it be done; should premiums be charged; should there be an upper limit on the amount of coverage; and should there be a time limit on government participation.

A PRELIMINARY REPORT of the insurance study sponsored by the Atomic Industrial Forum and conducted by Columbia University concluded that the Federal Government has a responsibility to place a ceiling on the amount of liability for which the reactor industry must provide through normal channels, but that the Government must not compete with private insurance companies.

THE ASIAN NUCLEAR CENTER, proposed by the U. S. last October to the Colombo Plan member nations, will be built in the Republic of the Philippines. The Center will provide a facility for Asian nuclear training and research. The U. S. has offered to provide funds for laboratory facilities and equipment, to supply a reactor, and to supply facilities for nuclear research in medicine, agriculture, and industry. The "offer" will take about $20 million from the $100 million Fund for Asian Economic Development.

Hot Bending at Pittsburgh Piping





This highly developed technique at P.P. & E. provides a smooth, trouble-free flow line for high pressure, high temperature service.

Bending heavy wall piping is an art which provides a pipe line having best flow characteristics, with turbulence held to a minimum.

Pipe bending saves fabricating time and material . . . permits designing the pipe line to fit exactly into available space. There are fewer welds in the completed system, and field welding can be confined to areas least subject to high stress. Pipe and bends are of the same material . . . and, as produced at P.P.&E., wall thickness and metallurgical and mechanical properties are consistent throughout the fabricated assembly.

Comparatively few men are qualified by training, experience and skill to bend pipe for high pressure, high temperature service . . . fewer plants have the necessary facilities. P.P.&E. has both the men and facilities.

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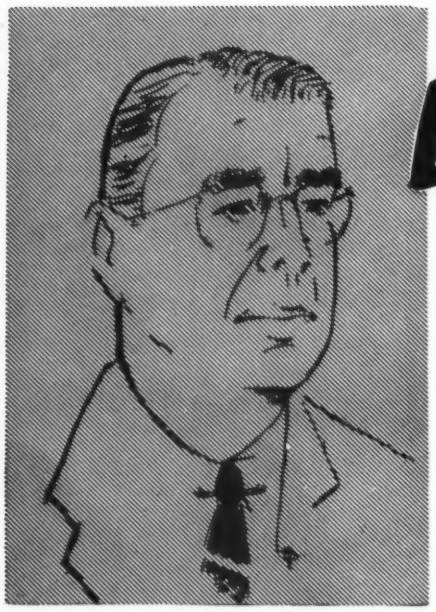

E. A. MacDonald
INDUSTRIAL ECONOMIST

ECONOMIC News Notes

YESTERDAY'S LESSON — In announcing the record volume of contract awards for March and the first quarter, Mr. T. S. Holden of the F. W. Dodge Corporation stated that the figures may indicate that "none of us comprehends quite fully the present growth potentials of the U. S. economy." In retrospect, Mr. S. Schoeffler, of the University of Massachusetts, makes a similar criticism in his recently published book, "The Failures of Economics," (Harvard Univ. Press) to the effect that economists "misjudged the entire temper and spirit of the economy in the immediate post-war period." These are particularly significant charges in view of the great growth and shifts of population projected for the 1960s.

SCHOOL BUILDING — The report on school needs released by the U. S. Office of Education recommended construction of 476,000 new classrooms costing $16 billion between now and the fall of 1959.

WORLD-WIDE — The drive to expand steel-making facilities is not confined to the U. S. In fact, the current expansion program has no national boundaries. It is reported that world capacity will be stepped up almost

Continued on page 29

from a SINGLE ITEM to COMPLETE LABORATORIES . . . and MOBILE UNITS for Soils, Concrete and Asphalt testing.

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30% in the next four years. The largest increase is slated for Russia, which is said to be increasing its reported present capacity of 50 million tons by 25 million tons. By comparison, 17 million tons will be added to the present 128 million tons capacity of the U. S.

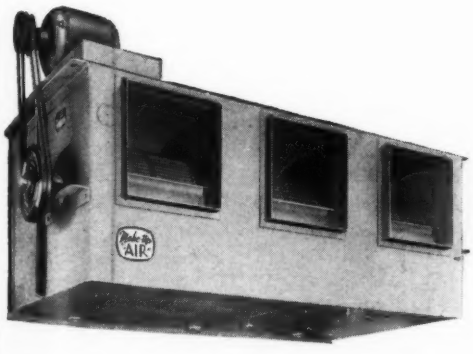
PERENNIAL GROWTH — Indicative of the growing backlog of expansions and improvements pressing on all municipalities — and of the likelihood of ever-higher tax bills — is the five-year, $675 million capital improvement program announced by Chicago. This is more than 2½ times the total outlays of the preceding five-year period. Highways and water and sewer installations will account for about three-fourths of the total.

HIGHER PRICES — Another round of inflation is in the making says Mr. Roy Wenzlick, St. Louis real estate expert. Savings are not going to be sufficient to finance consumer credit and mortgage debt in the next two years, and an expansion of currency and credit will occur, he claims. He looks for construction this year to equal and possibly exceed 1955, with industrial building showing a gain of 10-15%, commercial a gain of 9-10%, and residential building down by 100,000 starts.

"A TIME TO BUILD UP" — Combined with such economic stimuli as growth of population and suburban development, the prevalent belief that "church-going families make the best families" has resulted in a nation-wide surge of church construction. The $760 million of construction put in place for this purpose last year was 25% greater than in the preceding year, and it is expected that the total will rise to $900 million this year. It has been estimated that 70,000 churches costing $7 billion will be erected in the next 10 years.

FEDERAL LESSEE — Requests for bids went out last month for the first five post office buildings of the 27 that have received Congressional approval. Mr. O. A. Kieb, Assistant Postmaster General, states that more than 60% of the nation's post office buildings require modernization and that 3,500 new ones should be built to handle the vastly increased requirements of suburban growth. The P. O. plans on getting new construction financed with private funds and then using the buildings on a lease-purchase contract or on a long lease.

THROUGH THE TRANSIT — Ad-of-the-Month, "Young Engineers ME-EE Up To $10,000 to Start" . . . Union Carbide & Carbon figures that for every $1 billion spent for industrial research, capital outlays of from $5 to 20 billion must be made . . . Georgia Power Co. has applied for permission to construct a $13 million, 60,000 kw hydroelectric plant and dam on the Chattahoochee River just north of Columbus . . . Among the new industrial districts recently announced is the Eddystone (Pa.) Industrial Center. The site, containing 2.3 million sq. ft. of ground floor space, will be one of the largest developments of its type in the nation . . . The first quarterly plant location survey for 1956 by "The Journal of Commerce" (April 3 issue) presents data on more than 1,500 locations in 46 states and Puerto Rico suitable for chemical or allied industries . . . Consolidated Edison of N. Y. plans to spend $650 million for construction in the next five years . . . Pres. R. J. Cordiner believes it possible that GE employees may be earning $8,000—$9,000 on the average by 1966.



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10 to 600 h.p.
15 to 200# Oil, Gas
or Oil-Gas Combination.

"In our business," reports Mr. B. R. DeWitt, "we can't afford delays. When we need hot water for a mix or steam for thawing in cold weather — we need plenty of it, on time! AMESTEAM GENERATOR has always delivered for us. Just push a button—you've got steam in a few minutes. Maintenance is almost nil, and our AMES representative is ready with service 24 hours a day. Sure, we ordered AMESTEAM GENERATOR for every new DeWitt cement plant. We know we can depend on their rugged dependable equipment."

"REPEAT" ORDERS

like those of B. R. DeWitt, Inc., Pavilion, N.Y. Road Builders, are continual proof of user satisfaction with AMESTEAM GENERATORS.

2 MORE ORDERED

Besides the seven units in DeWitt plants, Mr. DeWitt has ordered and just taken delivery on two additional units for new plants in the vicinity of Rochester, N.Y. The 9 AMESTEAM GENERATORS range in size from 40 to 80 h.p.

For satisfaction like this — for dependable steam production and economy over the years — you take no chances when you specify AMESTEAM GENERATOR!

MAIL COUPON TODAY!

AMES IRON WORKS, INC.
BOX P-56, OSWEGO, N. Y.

Gentlemen:

Please send me further information on AMESTEAM GENERATORS and name of the nearest representative.

NAME.....

COMPANY.....

ADDRESS.....

AMES IRON WORKS INC.
BOX P-56 OSWEGO, N. Y.

CLYDE "SAN FRANCISCO BAY BRIDGE" HOISTS TEAM
WITH NEW CLYDE STEEL ERECTORS' HOISTS

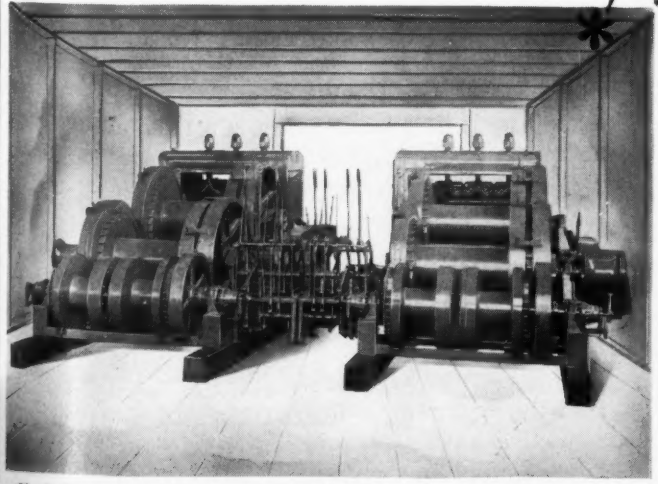
Spotting Steel on World's Largest Suspension Bridge

The twenty-four year old Clyde hoists operating the barge mounted derrick shown at right are proof of Clyde's sound engineering, quality construction and long-life dependability! Built in 1934 for The American Bridge Division, U. S. Steel Corp., for the San Francisco Bay Bridge job, these dependable units have been used almost continuously on a wide variety of applications ... from one 'world's longest suspension bridge' to a new 'world's longest suspension bridge' now being constructed across the Mackinac Straits! Here's a record of an active, profitable life span of more than two decades under severe and exacting conditions!

The engineering and structural advantages of Clyde's complete line of hoists are long-life, quality-plus Clyde features. Their capacity to do a job profitably recommends Clyde for the consideration of the most critical and cost-wise buyer.

Clyde's advanced engineering principles assure long, continuous, economical, safe and easy operation.

Two Clyde Frame 8 Hoists will operate the Creeper Derrick shown below as it was being erected on the third tier of the main suspension tower of the Mackinac Straits bridge job

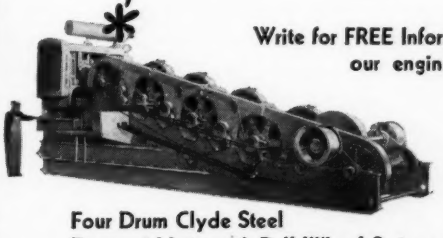


Clyde Twin Unit Hoists built in 1934 for American Bridge Company, used on San Francisco Bay Bridge ... Now in use on Mackinac Straits Bridge.

Here is equipment built to shave critical dollars from competitive bids now and a quarter of a century away!

If your material handling requirements call for dependable equipment, it will pay you well to get the facts from CLYDE!

Write for FREE Information! The services of our engineering department are at your disposal.



Four Drum Clyde Steel Erectors' Hoist with Bull Wheel Swinger

HOISTS—DERRICKS—WHIRLEYS—BUILDERS TOWERS—CAR PULLERS—HANDI-CRANES—ROLLERS

CLYDE

CLYDE IRON WORKS, INC.

Established in 1899

DULUTH 1, MINNESOTA

ONE OF THE 12 INTEGRATED COMPANIES BARIUM STEEL CORPORATION

The Legal Aspect

MELVIN NORD, P.E.
Consultant in Legal and Technical Problems
Patent Attorney

The Law of Sales (II)

LAST MONTH we found that when there is a contract to sell specific goods and the seller must do something to put them into a deliverable state, the presumption is (in the absence of proof of a contrary intention) that title was to pass when this action by the seller was performed. If nothing was to be done by the seller at all, the presumption is that title passed when the contract was made. The following question was posed:

A, a manufacturer of dyes, received an order from B for 6000 lbs of a certain dye, with price and quality specified. A "accepted the order and promised to sell" and deliver the dyes. A had a large supply of the dyes on hand and was ready to make a shipment from his supply at any time, but B refused to give A shipping instructions and later cancelled the order. A now sues for the purchase price of the goods, which he claims B has purchased.

Can A recover the purchase price?

Held: No. There never was any sale, because the goods were not specific. There were no specific 6000 lbs of dyes that could be said to belong to B; any 6000 lbs would satisfy the contract. As a result, no title ever passed to B, and he cannot be sued for the purchase price. This does not mean that he is necessarily free of all liability. He certainly has breached a contract, and is liable for the damage caused A by the breach. But this damage amounts only to the difference between the purchase price under the contract and the reasonable value of the goods. If the market price available to A is the same as the purchase price in the contract there will be only nominal damages (i.e. six cents).

We now examine the presumption that prevails (in the absence of proof of a contrary intention) when the goods are not specific or ascertained at the time the contract is made. The presumption in this case is that title passed when goods of the proper description in a deliverable state are appropriated to the contract by some overt act by the seller with the assent of the buyer. If the goods were specific when the contract was made, we know that these are the exact goods that the buyer wishes to own. But if the goods were not specific when the contract was made, we cannot be sure that goods subsequently set aside by the seller on behalf of the buyer are the goods that the buyer wishes to own,— unless he expressly or impliedly assents to their appropriation. If the goods clearly conform to the contract, the buyer's assent will be implied. But if there is some question as to whether or not the goods conform to the contract, some evidence of the buyer's assent is necessary, such as paying for them or accepting delivery after having had an opportunity to inspect them. The most common act of appropriation by the seller is delivering the goods or placing them in the hands of a common carrier for delivery to the buyer.

The A,B,C's of Sales

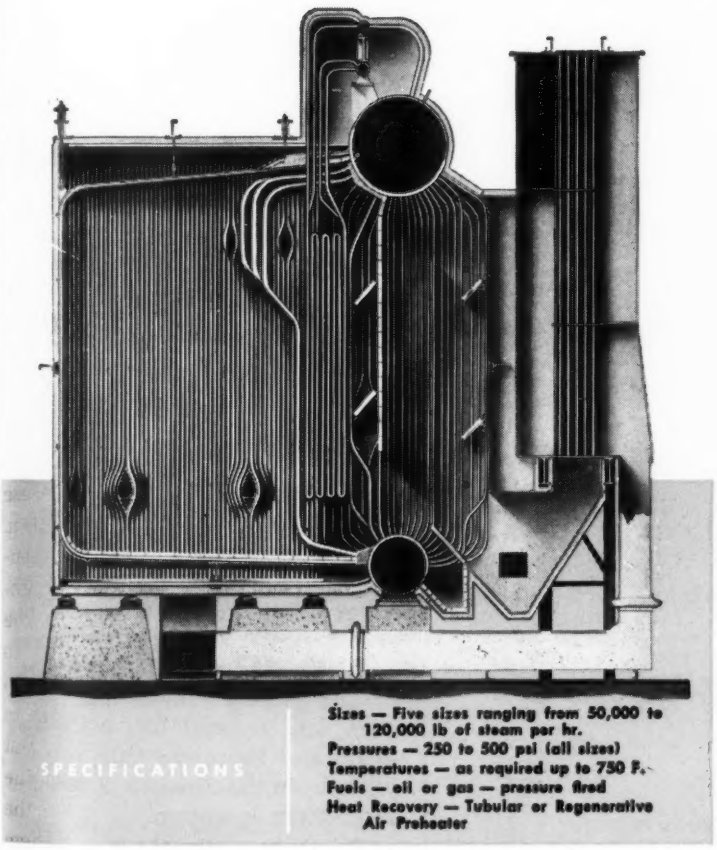
The letters C.O.D., F.O.B., and C.I.F. can cause a considerable amount of confusion unless their legal effect is understood. This is in addition to knowing what the letters stand for.

The letters C.O.D. mean cash on delivery. This means simply that delivery is not to be made unless the purchase price is paid, but it does not prevent title from passing. If, according to the law of sales, the buyer would be the owner of the goods, he is the owner despite the fact that he hasn't paid for them and can't even get possession of them. The seller holds them as security for the purchase price only, having the lien of an unpaid seller in possession. Thus, if the goods should be destroyed while still in

NEW VU-55

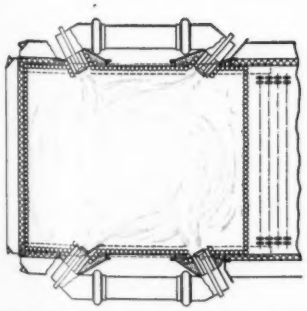
TODAY'S OUTSTANDING BOILER BUY

for capacities from 50,000 to 120,000 lb of steam per hour!

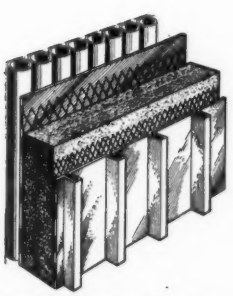


SPECIFICATIONS

Sizes — Five sizes ranging from 50,000 to 120,000 lb of steam per hr.
Pressures — 250 to 500 psi (all sizes)
Temperatures — as required up to 750 F.
Fuels — oil or gas — pressure fired
Heat Recovery — Tubular or Regenerative Air Preheater



PLAN VIEW OF FURNACE showing arrangement of burners for tangential firing. Flame streams from the four burners impinge upon one another at high velocity, creating a turbulence unattainable by any other method of firing. The result is rapid and complete combustion. As the gases spiral upward, they sweep all furnace heating surfaces, assuring a high rate of heat absorption.



PERSPECTIVE OF FURNACE WALL. Construction consists of tangent tubes backed up successively by welded steel panels, 4 inches of high quality insulating material and an outer steel casing formed as shown to provide adequately for expansion and assure ample strength. Low heat loss and the tightness required for pressure firing are assured by this welded, double-wall construction.

The VU-55 — a development of Combustion's basic Vertical Unit design — offers features never before available in a boiler of its capacity range. If your steam needs call for a unit in the 50,000 to 120,000-lb class, you will find it worth while to consider the economic and operating advantages assured by these VU-55 features:

TANGENTIAL FIRING. More than 20 years of application experience have established the exceptional advantages of tangential firing, illustrated and briefly described below. About 90 percent of Combustion's large utility installations use this advanced method of firing.

DOUBLE WALL, PRESSURIZED CASING. The latest development in casing construction for pressure firing of boilers in the size class of the VU-55, this casing, as illustrated and described below, is designed to assure lifetime tightness with minimum heat loss. Pressure firing permits the elimination of an induced draft fan with its attendant operating and maintenance costs.

TANGENT FURNACE TUBES. The VU-55's furnace tube arrangement provides complete heat-absorbing, water-cooled protection on all furnace walls. Furnace maintenance is minimized, since the design eliminates all exposed refractory surfaces.

HIGH STEAM QUALITY. Equipped with a large (60-in.) steam drum, the VU-55 has generous water capacity and steam reservoir space. C-E drum internals assure high quality steam at all ratings.

STREAMLINED EXTERIOR. The overall appearance of the VU-55 reflects the efforts of its designers to achieve a completely unobstructed casing, while retaining adequate access wherever required and every facility for convenient operation. There are no outside downcomer tubes, and ducts from air heater to burners are beneath the furnace floor.

Your request for further information on the VU-55 Boiler will receive prompt attention

COMBUSTION ENGINEERING

Combustion Engineering Building, 200 Madison Avenue, New York 16, N. Y.
CANADA: COMBUSTION ENGINEERING-SUPERHEATER LTD.

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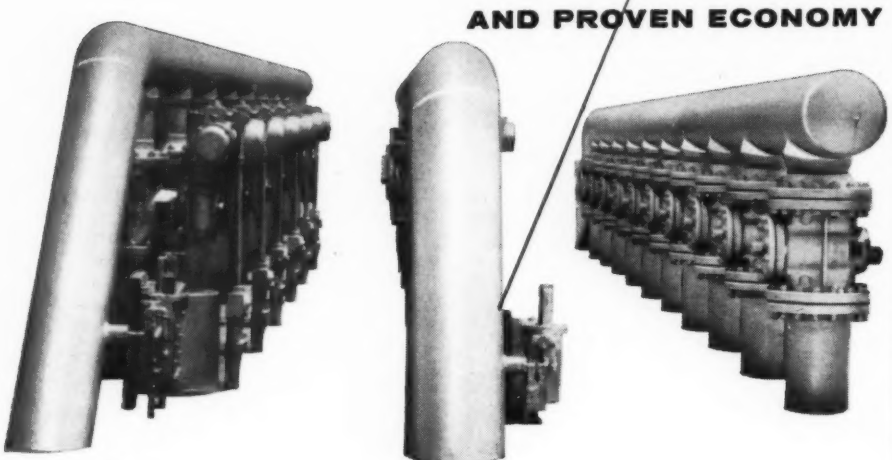
WELDOLETS

FOR ASSURED STRENGTH
AND PROVEN ECONOMY



WELDOLETS

THREDOLETS

SOCKOLETS

Are y o u effecting this economy for your company? Neat and uniform appearance is evident in code constructed weldolet headers in this crude oil pipeline terminal. The money saved is in the bank and does not appear in this picture. If you are not using the weldolet method of cutting piping costs, write today for information.

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WELDING FITTINGS DIVISION
BONNEY FORGE & TOOL WORKS
370 GREEN ST., ALLENTOWN, PA.

the seller's possession, but through no fault of his, the buyer owes the full purchase price of the goods. And the seller has no right to resell the goods immediately to another purchaser. However, after the buyer has been given a reasonable time in which to pay, the seller has the right to foreclose his lien by selling to another buyer (keeping any excess profits thus produced, but still having a right to recover any loss from the defaulting purchaser). Or, the buyer can rescind the sale altogether, after a reasonable time has passed. The right to rescind a sale for failure to pay is limited to an unpaid seller in possession. If he is not in possession he cannot get the goods back, but is merely a general creditor.

A C.O.D. sale must be distinguished from a technical cash sale. The latter term means that the parties expressly agree that title is not to pass until payment has been made. There never is a presumption that a technical cash sale is intended; the letters C.O.D. definitely do not have that effect.

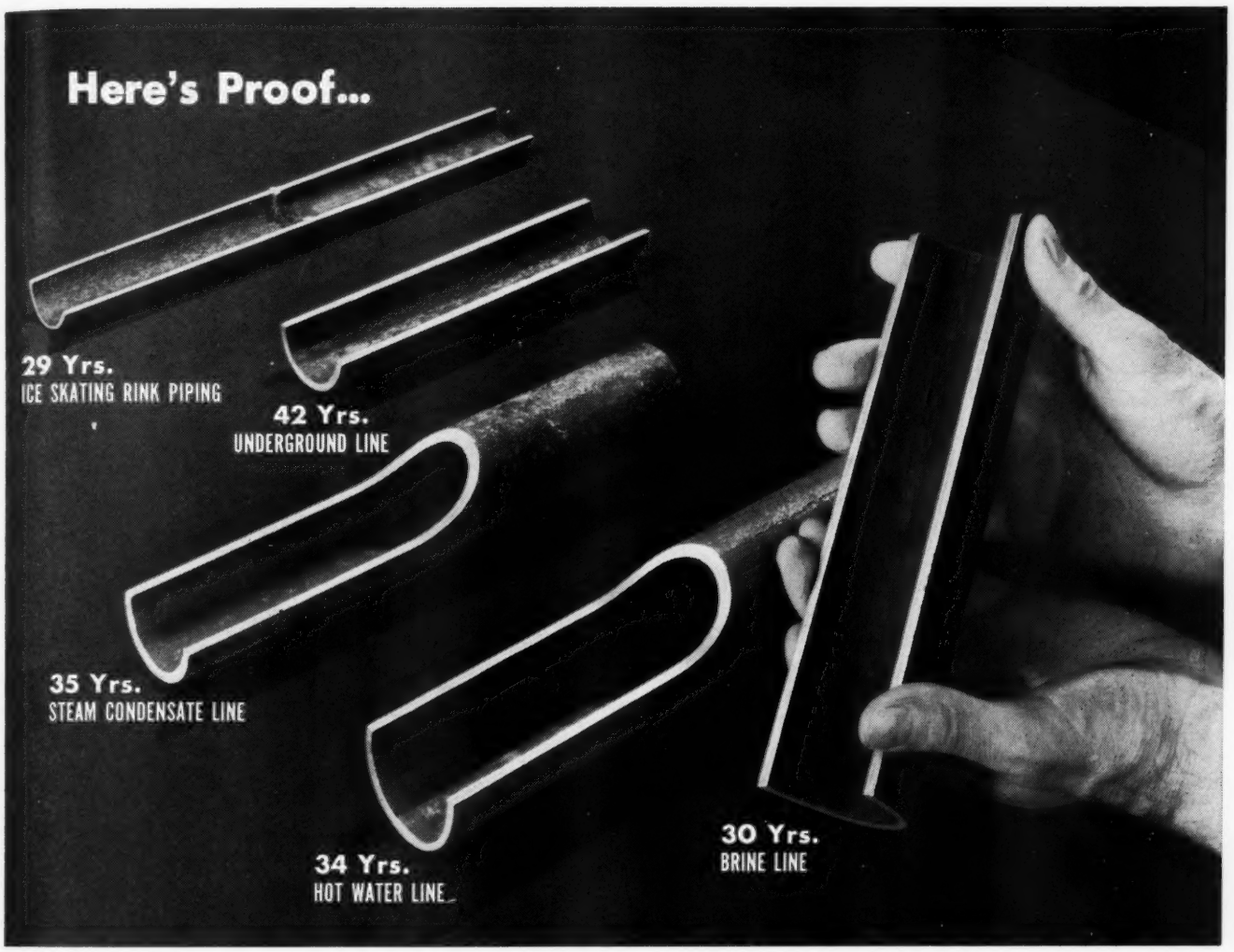
The letters F.O.B. mean freight on board. They indicate that the seller has agreed to place the goods aboard a carrier at a specified place, free of freight charge to the buyer. Unless the seller does this, he still has something to do and therefore title has not passed—in the absence of proof of a contrary intention.

The letters C.I.F. mean cost, insurance, and freight. They indicate that the price includes the cost of the goods, the cost of insuring them on behalf of the buyer during transportation, and the cost of freight to the buyer. When goods are shipped this way, it is held that this clearly expresses the intention that title passes when the seller places the goods on board the carrier, pays the freight, and procures the necessary insurance.

Approval Sales

A very perplexing practical problem in sales relates to sales on approval and similar types of transactions.

When the seller delivers goods to the buyer on approval, it is held that no title passes unless



WROUGHT IRON PIPE Saves because it Serves longer

True, there's no set rule for predicting how long a pipe material will last in any corrosive service. But there are a lot of mighty dependable clues. The most practical and dependable of all is *service under actual field conditions.*

How does wrought iron pipe measure up when this service-life yardstick is applied?

The answer is documented in the pipe sections shown above. Here you see *actual* samples taken from wrought iron pipe installations in a variety of services. Some of these sections came from buildings that were being torn down. Some were actually cut from in-use installations by our laboratory staff. These sections are interesting not only from the viewpoint of service life, but also pipe condition.

You'll find the reason for wrought iron pipe's ability to last longer in the material's structure and composition. Tiny fibers of glass-like iron silicate are threaded throughout the body of high-purity iron. These fibers are immune to corrosive attack. When corrosion strikes, these fibers halt and detour the attack, prevent rapid pitting and penetration. When you consider that there are more than 250,000 of these fibers to each cross-sectional square inch of wrought iron, it's easy to understand why this material is more than a match for corrosion.

Our bulletin, *Piping for Permanence,* tells more of this story, and covers a variety of services where wrought iron pipe saves because it serves longer. Write for your copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. International Division: New York, N. Y.

Available in Canada and throughout the world.

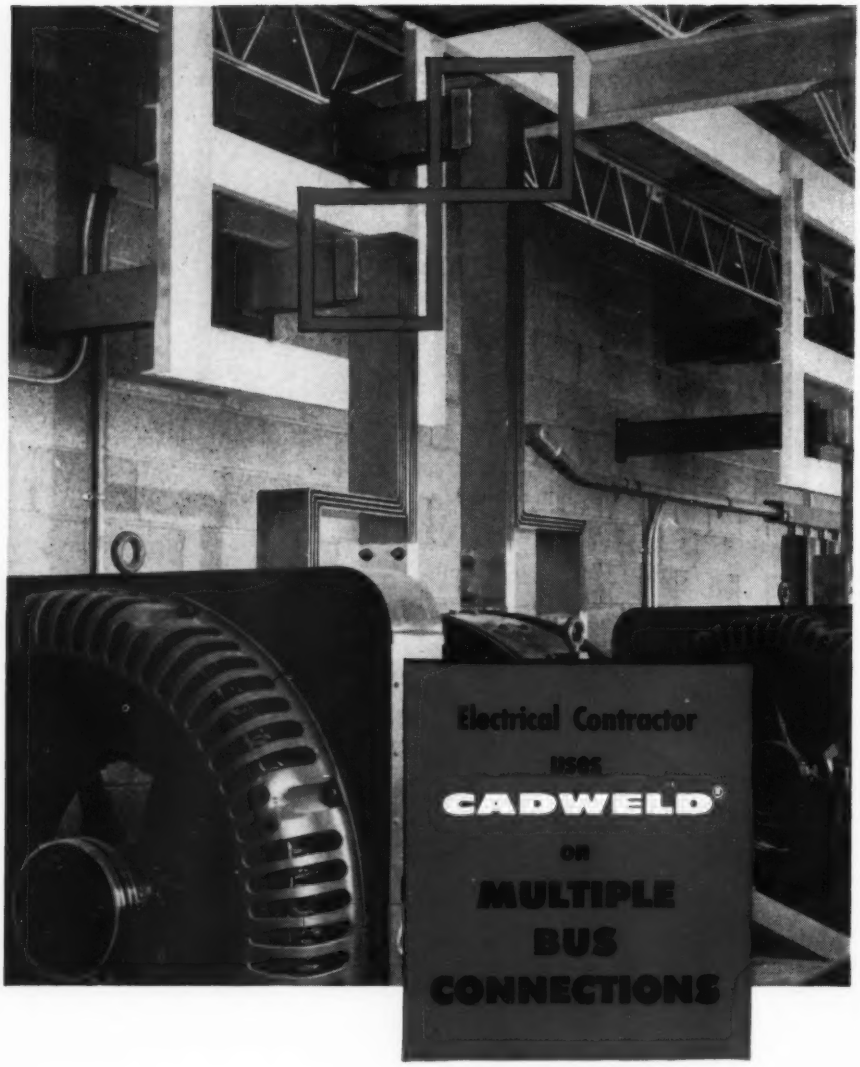
BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY STEEL PRODUCTS



Carlson Electric Co., Youngstown, Ohio used CADWELD Electrical Connections on three large multiple bus installations during 1955.

According to Mr. William P. Burkey, Carlson's Chief Engineer;

1. **CADWELD Connections reduce the labor cost.**
2. **CADWELD Connections result in a superior electrical installation that cannot loosen or corrode and is maintenance free.**

Jobs involved various sizes and number of bus, ranging from a splice of ¼" x 2" bus up to a splice of eight ¼" x 6" bus.

Before figuring your next bus installation, investigate **CADWELD.**

CADWELD®

Erico Products, Inc.

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and until the buyer indicates his approval expressly or impliedly (e.g. by keeping them beyond a reasonable time). Thus, title remains in the seller, and if the goods should be destroyed without the buyer's fault, he is not responsible for the loss.

On the other hand, if goods are delivered to the buyer on sale or return, this means that the title has passed to the buyer, but he has the privilege within a specified time (or within a reasonable time) of returning them to the seller and revesting title to him. If the goods are damaged or destroyed, the loss is on the buyer.

The legal effects of these transactions are simple enough and readily distinguishable from each other. However, since sellers don't actually say "on approval" or "sale or return," we generally don't know which they meant. As a result, the application of these rules to practical cases is frequently a difficult problem even for those expert in legal matters.

A Problem

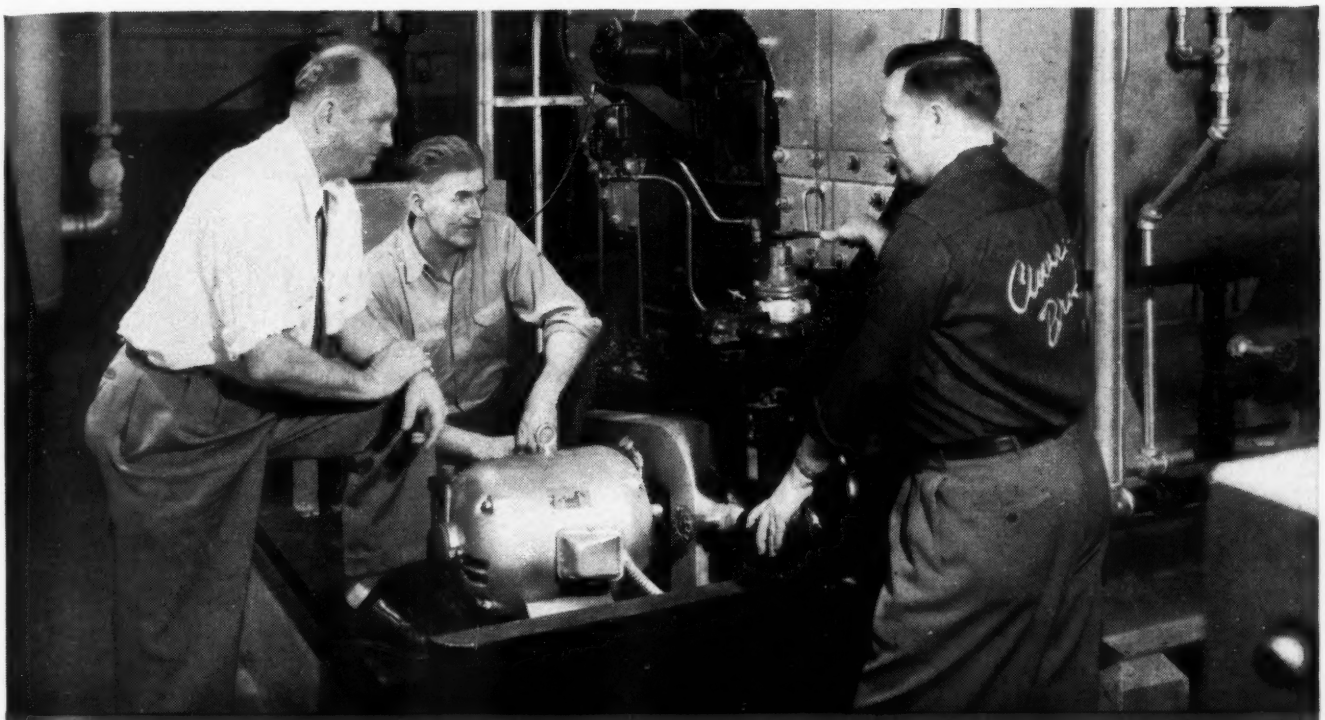
The following problem is based on the above principles—the answer will be given next month.

On Jan. 27, 1931, a written contract was made for the sale by P to D of a machine for the automatic packing in cartons of "Tastyeast bars" made by D. The contract provided: "The machine will be sent on 30 days trial, entirely subject to your approval before acceptance. If machine is not satisfactory to you in any way and is not accepted, we will, upon receipt of notice to that effect, receive said machinery without any charge to you. If the machine is not accepted you are to return it to us and at that time your every obligation to us will cease. If accepted, the price becomes due at the expiration of the 30-day trial period.

The machine arrived at D's factory on April 4, 1931, and was found (by the jury) to be capable of performing as required by the contract. D made no complaint until Aug. 25, 1931, when it declared the machine to be unsatisfactory and offered to return it. Was D liable for the purchase price? ▲▲

A good start is a sure way

to maintain highest boiler efficiency



Cleaver-Brooks factory-trained servicemen instruct your operating personnel and adjust your boiler for peak efficiency. This service doesn't cost you a cent.

OTTO POLZIN is a typical Cleaver-Brooks factory-trained serviceman. He is shown on the job at Oilgear Co., Milwaukee, where he has just given two 125-hp Cleaver-Brooks boilers an initial start. Norbert Husting and Gordon Knischke of Oilgear are getting all the details on boiler operation and maintenance, including boiler blow-down procedure and tube cleaning.

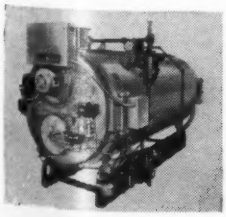
While on his "starting service call", Otto covered all of 32 items on his check list — such as the entire lubrication system, a CO_2 reading, inspected and cleaned relay points. In short, he *personally* made sure both boilers were "tuned" to perfection!

Cleaver-Brooks service is nationwide

This service is "standard practice" everytime a Cleaver-Brooks boiler is put into operation. And, as thousands of owners know, a phone call to your local Cleaver-Brooks representative brings this and other specialized services when needed.

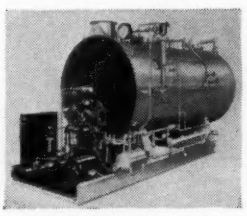
Factory-supervised starting is just one of many advantages of being a Cleaver-Brooks boiler owner. You get the ultimate in modern boiler design: forced draft with four-pass construction, hinged or davited front and rear doors for fast cleaning, 10-second gas or oil interchange — just to name a few features.

Get the full story on the complete line — sizes from 15 to 600 hp; 15 to 250 psi. Call your nearby Cleaver-Brooks representative or write direct. Cleaver-Brooks Company, Dept. F, 320 E. Keefe Ave., Milwaukee 12, Wisconsin, U.S.A. Cable Address: CEEBEEWEST — all codes. Ask for catalog AD-137.



MODEL CB — Most silent-running boiler on the market. Ideal for schools, hospitals. Sizes: 15 to 150 hp.

MODEL LR — Standard of the industry for steam or hot water service in heating or processing applications. Sizes: 200 to 600 hp.



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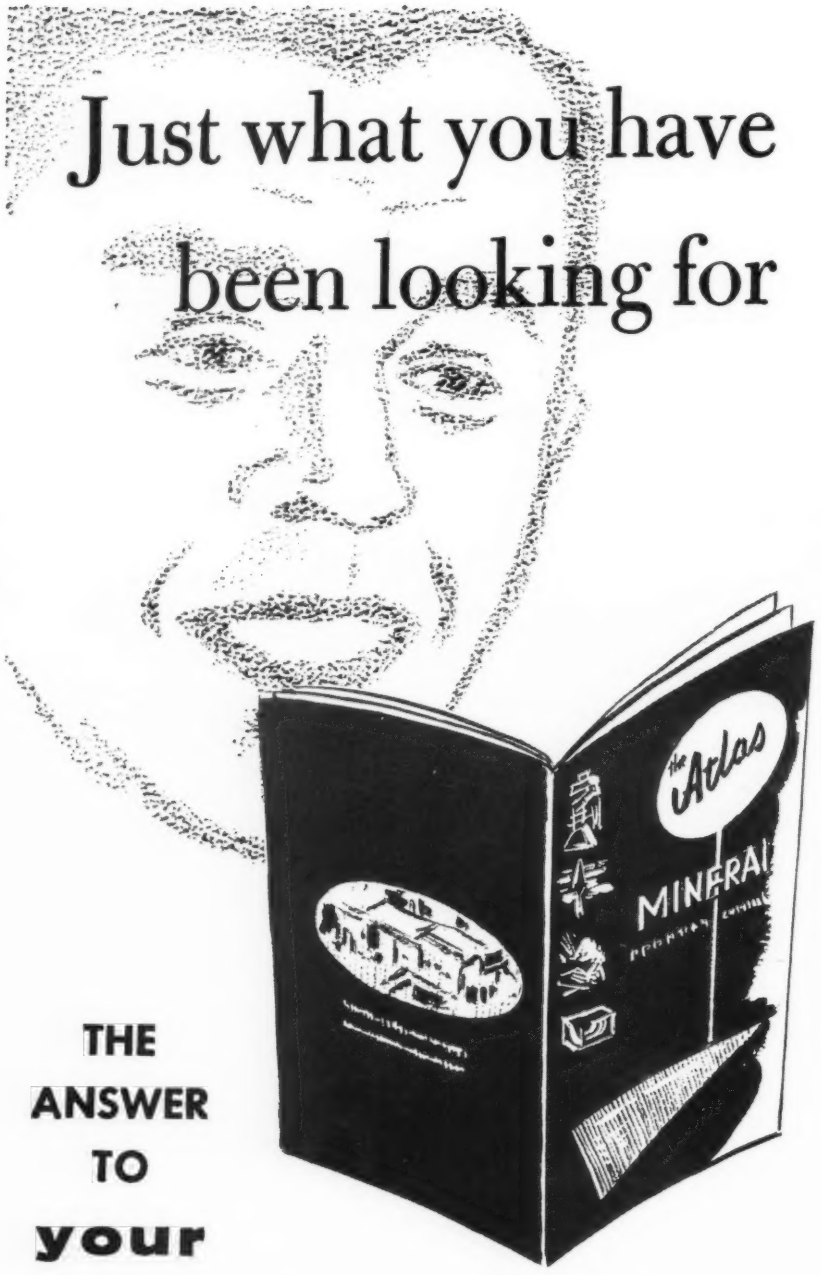
TWENTY-FIVE YEARS OF LEADERSHIP
BY THE ORIGINATORS OF THE SELF-CONTAINED BOILER



THE ANSWER TO your corrosion problems

A completely new sixteen page bulletin on corrosion proof materials of construction. . . . Individual sections on CORROSION PROOF CEMENTS, PROTECTIVE COATINGS, TANK LININGS and RIGID PLASTIC STRUCTURES and PIPE . . . also sections including engineering design and corrosion resistance charts.
This bulletin is filled with valuable information on 18 materials that can be used to give you plant-wide protection from corrosion.

FOR YOUR COPY
WRITE TO

ATLAS MINERAL PRODUCTS COMPANY
MERTZTOWN, PENNSYLVANIA

TECHNICAL REPRESENTATIVES THROUGHOUT THE UNITED STATES

Consultants Leave On European Tour

A group of consulting engineers, most of whom are accompanied by their wives, are leaving Idlewild International Airport, New York, on Sunday, April 29, for a tour of Europe and visits with European consultants. At the first stop, in London, there will be a luncheon with the British Association of Consulting Engineers, followed by meeting with individual consultants at their offices and projects.

In Holland, the Dutch Association has arranged a full schedule of luncheons and visits including one to the new pumping projects designed to reclaim land from the Zuyderzee.

In Germany, the group will visit Essen and Dusseldorf, where they will lunch with the German Association and visit projects of the members.

The Swiss have arranged a particularly interesting program including a visit to Winterthur Cantonal Hospital, now under construction; lunch at Laufen Castle, on the Rhine falls; and a visit to the Rheinay hydroelectric plant now being built. The following day the group will have lunch with the Swiss Association at Zunfthaus zur Meise (House of the Vintners Guild) which was built in 1757.

There will also be slightly over a week in Paris, at which there will be an opportunity to spend some time with members of the French Association.

All of these Associations are members of the International Federation of Consulting Engineers; and membership is restricted to engineers in private practice who have no connection with manufacturing or contracting.

The group will be led on this tour by Hunter Hughes, Editor of CONSULTING ENGINEER. Among those to be on the tour are: Hugh P. Duffill, Duffill Associates, Boston, Mass.; Mr. and Mrs. Victor Mayper, New York, N. Y.; Mr. and Mrs. A. V. Saph, Jr., San Francisco, Calif.; Mr. and Mrs. William W. Moore, Dames & Moore, San Francisco, Calif.; Mr. and Mrs. Irving E. Brooke, Brooke & Choporis, Chicago, Ill.; Mr. and Mrs. Frederick M. Hill, New Haven, Conn.; Mr. and Mrs. G. C. McKinney, San Jose, Calif.; Mr. and Mrs. B. L. Nishkian, San Francisco, Calif.

Concurrently a group of European Consulting Engineers are visiting this country, arriving in New York on May 15.

this is "life insurance" for boilers

It's a good "policy" to protect your valuable boilers with YARWAY Boiler Level Indicators.

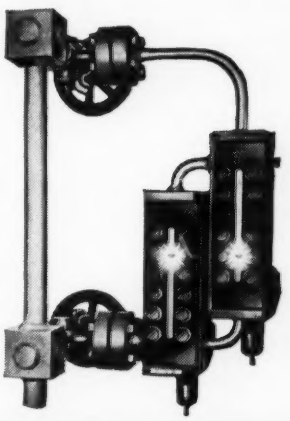
Instant . . . accurate . . . continuous remote readings of boiler water levels are available on the instrument panel or wherever you wish in the plant.

YARWAY's new "wide vision" face gives brilliant readings from any angle . . . and the pointer is always visible, even at extreme high and low water levels.

For brilliant "shines like a star" readings on the boiler drum you'll want to use YARWAY Flat Glass Gages with Type "M" Illuminators.

From drum to panel and at all remote locations, YARWAY equipment gives you the safest boiler protection you can buy—proved beyond doubt in nearly 10,000 installations.

◀ Yarway Remote Liquid Level Indicator. Write for Yarway Bulletin WG-1824.



Yarway Flat Glass Water Gage with Type "M" Illuminators. Write for Yarway Bulletin WG-1812. ▶

YARNALL-WARING COMPANY
106 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY **steam plant equipment**

ALFRED L. McCAWLEY
Counsel, Missouri Engineering Registration Board

Most of the hue and cry over corporate practice is based on misunderstanding. Here, a recognized expert gives his personal ideas of what should be done about . . .

The Corporate Practice of Engineering

PERHAPS THE MOST important and far-reaching question now being discussed by members of the engineering profession and registration boards of the various states relates to the extent, and under what conditions, corporations may offer and render engineering services to the public. It appears to have been understood for many years that some provision should be made for corporate practice of engineering; otherwise, so many state laws would not contain provisions authorizing it.

In order to give effect to the purposes of engineering registration laws — the protection of the public — some workable, constitutional, and as near uniform provision as possible defining the manner in which, and to what extent, corporate practice of engineering shall be permitted, should be enacted into all state laws as quickly as possible.

It is my purpose here to promote immediate, serious, and intensive discussion of the problem of corporate practice of engineering with the thought that interested groups may reach agreements under which they can, in full accord, go before the legislative committees of state legislatures in 1957. Forty-eight state legislatures meet in 1957, most of them convening in January. With legislatures meeting at two-year intervals, it is important that the question be settled in as many states as possible in 1957, rather than have it delayed to 1959, 1961, or perhaps later.

More progress could be made, and more satisfactory results obtained, in a study of the problem if interested groups first could come to an agreement on terminology. It would help matters if the words "practice" and "registration" could be used exclusively in referring to natural persons. Some other words are needed in referring to corporations that exercise their rights, under certificates of authority issued to them by registration boards, to engage, use, and offer the services of registered engineers to the general public.

It has been clearly affirmed many times in this country by courts of final authority, over a period of eighty years or more, that corporations cannot *practice* a learned profession, and engineering has been defined as a learned profession. This was recently stated in a clear decision handed down by the U. S. Court of Appeals in the District of Columbia, (Potomac Engineers, Inc. v. Walser et al). The Court of Appeals decided:

"Obviously a corporation cannot take an examination. It is clear to the Court that the statute must be construed by its very terms as inapplicable to corporations and applicable to natural persons only.

"It may be added that traditionally only natural persons may practice a learned profession, because only natural persons can be charged with the moral responsibility that practice of a learned profession requires. While traditionally the learned professions have been regarded as the law, medicine, and the ministry, I think that engineering too, may properly be included in that class."

However, no court of last resort has ever declared, so far as I have been able to find, that a state, through legislative action, cannot prescribe conditions under which corporations may make engineering service available to the general public through the employ-

ment and use of registered engineers — nor has any court prevented a legislature from prescribing conditions under which professional engineers may practice through the medium of a corporation.

Any engineering registration law that requires, in one provision, a natural person to acquire an engineering education, pass an engineering examination, acquire four years engineering experience and secure registration before he may engage, or offer to engage in engineering practice, and in another provision authorizes a corporation, which cannot acquire an engineering education, pass an engineering examination, or acquire engineering experience, to engage in the practice of engineering, dangerously approaches class legislation, and poses a serious threat to the law's constitutional validity.

The answer is that corporations should not be registered and permitted to *practice* engineering as corporations. But legislation should be passed to permit corporations to *solicit, offer and render engineering services* to the public through the agency of natural persons who are registered professional engineers, and to authorize registered professional engineers to engage in the practice of engineering through the medium of a corporation.

Here we can see the reason for some appropriate word other than "practice" to express the activities of corporations that offer the services of registered engineers to the public — and some other word than "registration" to designate the authority under which the corporations' engineering activities are carried on. It is essential, as the foremost consideration, that any amendments to engineering registration laws relating to engineering activities of corporations, and any conforming amendments to corporation laws, provide the highest degree of protection to the peace, health, and safety of the public.

Before any satisfactory solution to the problem of corporate practice of engineering can be reached, it should be understood that whatever statutes are enacted on the subject should deal exclusively with corporations. The use of the word "corporation" in such phrases as "firm, company, corporation, joint stock companies, and associations" should be abandoned. Statutes defining corporate practice of engineering and practice by individual, registered engineers through the medium of a corporation, should not involve any other type of business organization.

Moreover, organization management, and the control of corporations is a major subject of legislation and may not, except insofar as incidentally necessary, be treated in a license law requiring the registration of members of a profession.

Fair and Reasonable

Naturally, the provisions in any registration law relating to the corporate citizen must be fair, reasonable, and nondiscriminatory. Therefore, a provision requiring a corporation to give a bond in any sum, conditioned upon its obedience to the law, without requiring that a bond for the same purpose be given by an individual registrant, in all probability would be ruled by the Supreme Court in any state to be arbitrary, capricious, and discriminatory, thus rendering the act unconstitutional in part if not entirely.

Conversely, a clause in a registration law requiring registration of professional engineers, prescribing the qualifications required for registration, and providing that no person shall engage in the practice of engineering without registration, plus a clause in another part of the law permitting corporations to engage in the practice of engineering without the imposition of reasonable regulations that would afford the same protection to the general public, would be discriminatory in favor of the corporation. This might subject the entire law to the danger of being ruled unconstitutional.

The answer will not be found by inserting clauses in registration laws requiring bonds of corporations or requiring that officers, directors, or stockholders of the corporations should be registered engineers. The answer can only be found in language that will establish the rights of the corporation and leave the responsibility for the professional services to be rendered by or for the corporation to the individual

SENATOR ALFRED L. McCAWLEY

Former Senator Alfred L. McCawley, counsel for the Missouri Board of engineering registration, has had many years' experience in writing licensing and other regulatory laws based upon the police power of the state and directing their passage through the Legislature.

In 1941 he was counsel for a special committee of architects and engineers in writing and guiding the architectural and engineering registration law of Missouri through the State Legislature.

As a member of both the Senate and House of Representatives of Missouri through a period of twelve years, he was author and joint author of much of the police power legislation enacted while he was a member of those bodies.

For the past fifteen years he has been counsel for the engineering registration board of Missouri, which also registers architects and, since 1955, has registered land surveyors. He is the author of, "Professional Engineering Registration Laws."

Senator McCawley wishes it to be understood that neither the Missouri Registration Board nor any member thereof nor any other person is to be regarded as approving or disapproving any part of this article. It was prepared and submitted without the advice or suggestion of any other person.

engineer, who would be answerable at all times to his engineering registration board. He would be liable to having his registration permanently revoked for an illegal act done under the direction of a corporation just as he would be if the act were done by him as an individual registrant working on his own.

Laws Lack Uniformity

There is currently a lack of uniformity in state registration laws so far as corporate practice is concerned. Eighteen registration laws have no provisions expressly authorizing corporate practice of professional engineering. Six of these, Alaska, Delaware, District of Columbia, Kentucky, Puerto Rico, and South Carolina are wholly silent on the subject. The twelve others, though not specifically authorizing corporate practice, have exemption clauses that are open to various interpretations. These states are Connecticut, Idaho, Illinois, Kansas, Louisiana, Maryland, Massachusetts, Montana, New Hampshire, North Dakota, Virginia, and Washington.

Thirty-four registration laws include provisions, dealing with corporate practice of engineering. Such provisions range in extent from 21 words in Arizona to 693 words in the current New York law. Three states, New York, New Jersey, and California contain grandfather clauses. The Rhode Island registration law declares: "No . . . . corporation shall be registered."

The Missouri law authorizes corporate practice

Excerpts of Sections of 29 State Registration Laws

1. *Alabama:* "... the person or persons connected with such ... corporations, acting in a professional capacity or in responsible charge of the practice of professional engineering, is or are registered, or otherwise authorized to practice under the Alabama registration law."

2. *Arizona:* "No ... corporation shall engage in the practice of engineering unless the work is under the charge of a registrant."

3. *Arkansas:* "A ... corporation may not engage in the practice of engineering as a profession except through its officers, agents, or employees and then not unless one of the ... incorporators is a registered engineer and unless the practice of engineering as engaged in is done under the supervision and direction of a registered engineer; provided that either a ... corporation may engage in the practice of engineering with relation to its own property or business so long as such engineering practice is done under the supervision of a registered engineer."

4. *Colorado:* "... provided the person or persons connected with such corporation ... in charge of the designing or supervision which constitute the practice is or are registered as herein required of engineers. The same exemptions shall apply to corporations ... as apply to individuals."

5. *Florida:* "... that one or more of the principal officers of said corporation ... are registered professional engineers in Florida, and further provided that said practice shall be carried on directly by professional engineers duly registered under the Florida registration law."

6. *Georgia:* "... provided only such practice is carried on under the direction of professional engineers who are registered in the state."

7. *Hawaii:* "... the person or persons, connected with the corporation ... directly in charge of the professional work is or are duly registered, and provided further that the name or names of such person or persons has or have been filed with the board by such corporation ..."

8. *Indiana:* "... if such practice is carried on by professional engineers who are registered in the state."

9. *Iowa:* "... all principal designing or constructing engineers shall hold certificates of registration."

10. *Maine:* "... provided only such practice is carried on by professional engineers registered in the state."

11. *Michigan:* "...provided that all partners, officers, and directors of such organizations shall be registered professional engineers."

12. *Minnesota:* "...provided the person or persons connected with such corporation ... in responsible charge of such work is or are registered as required by the Minnesota registration law for the practice of engineering."

13. *Mississippi:* " . . . providing the person or persons connected with such corporation ... in charge of the designing, or supervision, which constitutes such practice, is or are registered professional engineers. The same exemptions shall apply to corporations ... as apply to individuals under the registration law."

14. *Nebraska:* "...provided such practice is carried on by persons registered under the Nebraska registration law."

15. *Nevada:* " . . . provided that the principal member or members of the . . . corporation . . . in responsible charge of engineering work be registered professional engineers under the provisions of the Nevada registration law."

16. *New Mexico:* "... provided only such practice is carried on by professional engineers registered in the state."

17. *North Carolina:* " . . . provided, however, the person or persons connected with such corporation . . . in charge of the designing or supervision which constitute such practice is or are registered as herein required of professional engineers. The same exemptions shall apply to corporations . . . as apply to individuals under the registration law."

under certificate of authority subject to the requirements: (1) all engineering work must be done by professional engineers registered in the state under the direction and responsibility of a registered engineer who is an officer of the corporation with rank at least that of vice-president; (2) filing annually a list containing the name, address, and registration number of each professional engineer employed by the corporation during all, or any part of, the preceding calendar year; (3) entering into a surety bond, at the option of the board, in a sum not exceeding $50,000; and (4) payment of a certificate fee of $50.00 and an annual renewal fee of $25.00.

Abridgments of provisions of twenty-nine registration laws specifically authorizing corporate practice of professional engineering are shown in the accompanying table.

Most provisions in engineering registration laws purporting to authorize corporate practice of engineering appear to have been inserted while the bill was in preparation or during the course of its passage through the legislature — for no other purpose than effecting its passage. Less than a dozen such provisions appear to have been included in registration statutes as a result of intelligent study on the part of the proponents of such laws.

In this problem of corporate practice, it must be recognized that there are some advantages to this type of business structure:

Perpetual succession, when that right is reserved

Permitting the Corporate Practice of Engineering

18. *Ohio:* "...provided only such practice is carried on by professional engineers who are registered in the state. No corporation shall be granted a charter to engage in the practice of professional engineering nor shall any corporation hereafter formed use or assume a name involving the word 'engineer' or 'engineering' or any modification or derivative of such term except a nonprofit membership corporation."

19. *Oklahoma:* "...only provided such practice is carried on under the immediate responsible direction of at least one registered professional engineer whose name and seal shall appear on all plans and other official documents issued in connection with such professional engineering practice."

20. *Oregon:* "...provided the person or persons connected with such corporation... in charge of the designing or supervision which constitutes such practice is or are registered as herein required of professional engineers; provided, however, that all professional documents named in section 52-301, issued by such corporation... shall bear the seal of the registered professional engineer or engineers of said corporation..."

21. *Pennsylvania:* "...unless the directing heads and employees of such... corporation in responsible charge of its activities in the practice of such profession are licensed and registered in conformity with the requirements of the Professional Engineers Registration Law, and whose name and seal shall be stamped on all plans, specification plates, and reports issued by such firm or corporation."

22. *South Dakota:* "The provisions of the South Dakota registration law shall apply to every corporation, domestic or foreign, engaged in the business of professional engineering,... within the state, except that a certificate of registration issued thereunder shall be held by its officers or employees having responsible charge of work instead of by such corporation."

23. *Tennessee:* "...provided at least one of the principals of such corporation... is in responsible charge of such practice and is registered as herein required of engineers, or is otherwise by the registration law authorized to practice. The same exemptions shall apply to corporations... as apply to individuals under said law."

24. *Texas:* "...provided such practice is carried on by only professional engineers registered in the state."

25. *Utah:* "...provided such practice is carried on by professional engineers authorized to practice under the provisions of the Utah registration law."

26. *Vermont:* "...provided only such practice is carried on by professional engineers, registered in the state."

27. *West Virginia:* "...only provided such practice is carried on by professional engineers registered in the state. No corporation shall be chartered in the State of West Virginia under any name which includes the word 'engineer,' 'engineers,' 'engineering' or any combination of the same, unless the purpose of the corporation is to practice professional engineering as defined by chapter thirty, article thirteen of the code of West Virginia, as amended, and one or more of the incorporators is a registered professional engineer as therein defined."

28. *Wisconsin:* "...only provided such practice is carried on under the responsible direction of one or more registered professional engineers. Any and all plans, sheets of design, and specifications shall carry the signature of the registered professional engineer who is in responsible charge."

29. *Wyoming:* "...provided the person or persons connected with such corporation... in active charge of the investigation, design or construction of any work which may constitute such practice, shall be registered professional engineers. The same exemptions apply to corporations ... as apply to individuals under the registration law."

in the corporate charter — this means that the existence of the corporation can never end without voluntary action on the part of its shareholders or as a result of a court decree of dissolution ending the life of a corporation for cause.

Limitation of liability — no stockholder in the corporation is liable for debts of the corporation beyond payment in full for his shares of stock except in cases where the obligation may have been created through his own unlawful acts.

The death or removal of an officer, director, or stockholder from a corporation does not affect the regular course of its business. The death of a partner operates to throw the business into the probate or surrogate court for administration by surviving partners, except for partnerships between large firms under a special partnership contract, fixing the rights of survivor or survivors of deceased partners and the obligations of surviving partners.

On the other hand, there is no substantial ground for the frequently expressed apprehension that if the practice of professional engineering by corporations is authorized in any state, fly-by-night corporations would spring up, and employ unknown and incompetent engineers to the injury of the whole engineering profession. Being liable for all damages incurred through negligence of its agents, including engineers in charge of its engineering work, a corporation would have neither inducement nor inclination to coerce one of its engineers into acts of malpractice.

Separate Legislation Required

The organization, control, and management of corporations is a major subject of legislation. The law of partnerships is another major subject of legislation, as is the registration of professional engineers. Every major subject of legislation should be treated separately to avoid the possibility of a legislative act being voided by court decree for violation of some constitutional provision to the effect that no bill shall contain more than one subject, along with such incidental matters as necessary to give effect to its main purpose.

Therefore, a study of corporation laws, as well as engineering registration laws, should be included in all further efforts to secure legislation defining the relation of corporations to engineering practice.

Stockholder Requirements

The security supposed to be afforded the public by engineering registration law is not enhanced by the fact that a professional engineer in charge of corporate practice of engineering in any state is an officer, director, or stockholder in a corporation. Such requirements might well impair such security, since a corporation is equally liable for misconduct, breach of contract, and acts of negligence committed by all employees of the corporation whether officers, directors, or employees. Where such stockholding requirements are part of the registration law, it might be argued in any action for damages against a corporation that the corporation had discharged its liability by conforming to a state law requiring delegation of authority to a particular agent, such as president, vice-president, director, or stockholder, and, having conformed to that law, should stand absolved from further responsibility.

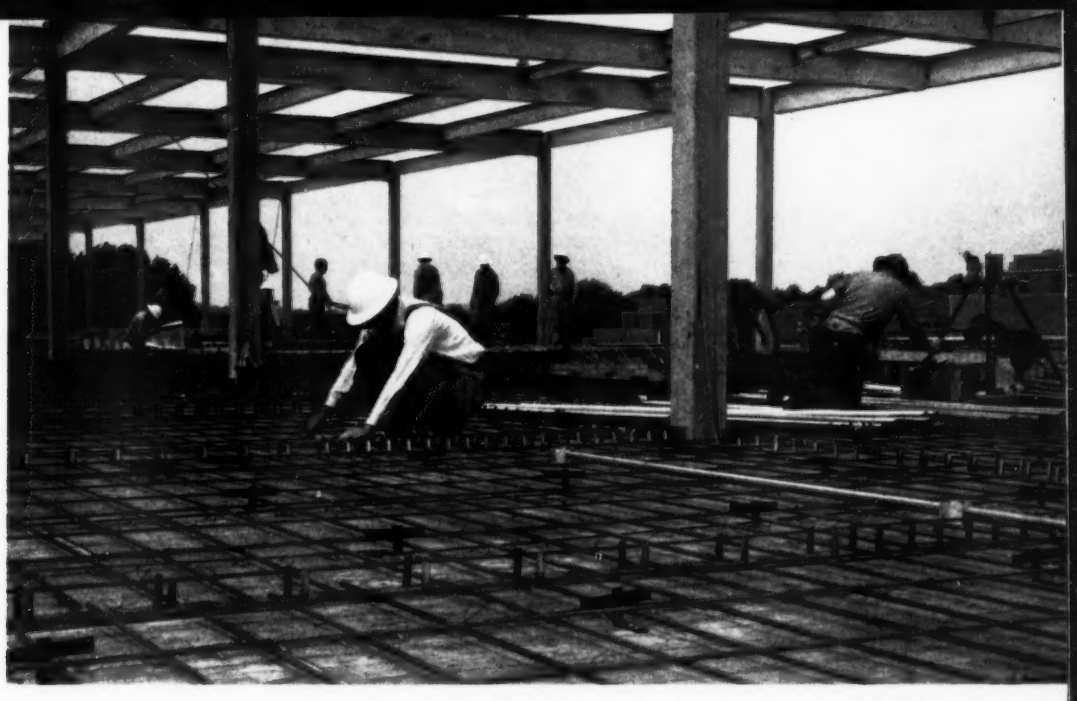
It would be far safer and afford a much greater protection to the public if the full responsibility of corporations for the acts of officers, agents and fellow-servants are left as now. In addition, penalties can be imposed by registration laws such as providing that the corporation shall be liable for all damages sustained as a result of any negligence, incompetence, and professional misconduct on the part of any professional engineer employed by it. Also, there should be a provision to the effect that when it shall be shown in any action for damages sustained through incompetent engineering services that the acts of incompetence were performed at the suggestion of and coerced by the corporation, then the corporation should be liable for actual damages in the amount fixed by jury, plus punitive damages in such amount as the jury may determine, not less than three times the amount awarded as actual damages.

Any idea that the public safety is enhanced by having an engineer hold stock in a corporation by which he is employed is highly illusory, to say the least. The public safety is far more secure in the hands of an engineer whose sole incentive is to so faithfully discharge his professional duties as to merit continuation of his rights as a professional engineer. To require him to be a stockholder in the corporation for which he works might create an irreconcilable conflict between his professional duties as an engineer and the hope for gain through investment.

A Fair Agreement

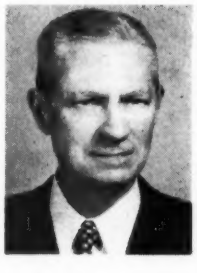
The argument will never end nor will any satisfactory solution of the problem ever be found, until the proper functions of engineering registration laws are understood to be limited to the granting of registration or license to professional engineers; to disciplinary control over the registered members of the profession within the jurisdiction prescribed by such laws; and to the administration of laws authorizing and regulating the engineering activities of corporations insofar as the administration of such laws are properly delegated to registration boards.

It all seems to boil down to the proposition that the future of professional engineering registration, the nation over, depends largely upon all contending groups reaching a fair, reasonable, and workable understanding among themselves and then getting it enacted into law by state and territorial legislatures as quickly as possible. ▲▲



VIEW OF LATHERS AT WORK PROVIDES EXCELLENT DETAILS OF THE BASIC CONSTRUCTION.

Composite Construction Makes Sense



GILBERT D. FISH, Partner, Seelye Stevenson Value & Knecht, received his C. E. degree from Columbia University in 1913. Following graduation he taught mechanics of materials and astronomy at Columbia and also served as an officer in the Corps of Engineers during World War I before starting an independent practice in his own name. In over 35 years in the consulting field, he has done innumerable noteworthy projects including the first welded building under the New York City Code of 1938. He also has developed and patented a system of elastically restrained steel beams which equalizes positive and negative bending moments; developed and applied hollow columns and girders for air-conditioned buildings; investigated the strength of rockets for the Army experimental program; and authored the book, "Arc Welded Steel Frame Structures." Registered in New York State, Fish is a member of Tau Beta Pi, Sigma Xi, ASCE, the Structural Engineering Advisory Panel of the Building Research Advisory Board, and the American Welding Society, having served on the latter's committees on Welded Buildings and Welded Bridges since their formation.

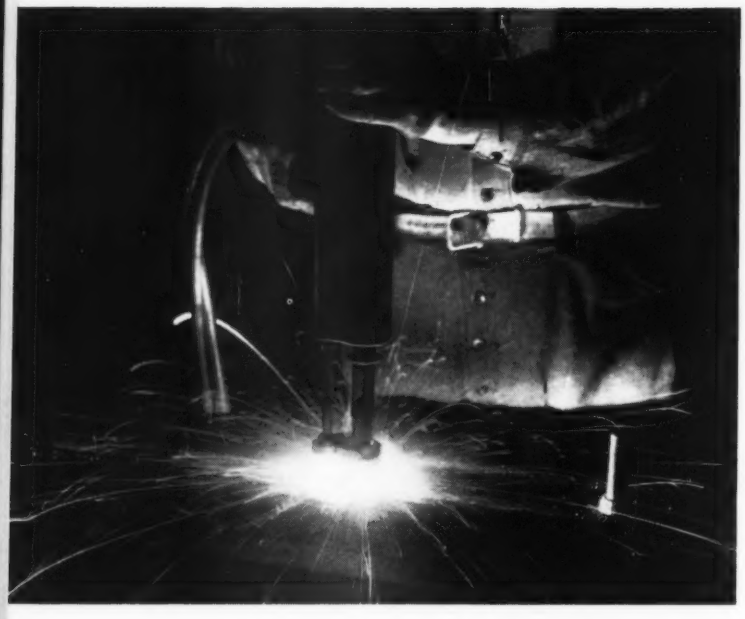
COMPOSITE CONSTRUCTION, which originated in Europe, about 1930, currently is receiving greater attention. Composite beams, consisting of rolled steel I-beams with reinforced concrete Tee-flanges anchored to them, frequently are used as stringers of highway bridges and viaducts on spans up to about 100 feet. For somewhat longer spans, built-up girders replace the rolled beams in forming the composite section. Yet the economic possibilities of composite framing in building construction still have not been widely recognized in this country, possibly because most of the spans in buildings are short in comparison with stringer spans in highway bridges. Whatever the reason, there have been comparatively few applications of composite framing in the building field.

Wherever a floor is to consist of a solid concrete slab on steel beams, it may be designed with lighter steel if the slab is anchored to the beams to form composite sections. The saving in steel varies with the design, and it is greatly increased by providing a bottom cover plate on each beam. This lowers the neutral axis of the composite section and makes the steel act more effectively. Placing the top of the steel several inches below the underside of the concrete slab, with a concrete haunch filling the space, adds further to the economy.

Steel Savings With Shoring

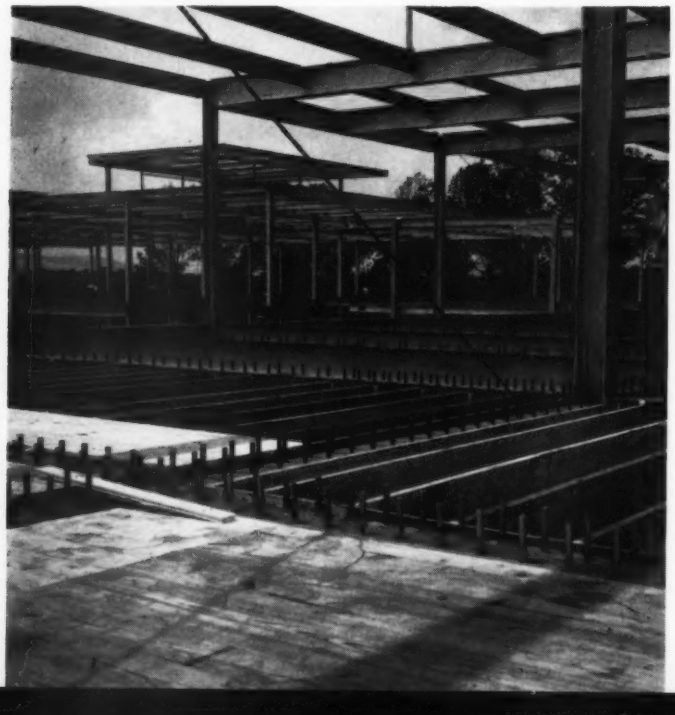
A rough idea of the savings in steel effected by composite design, where the steel member is shored during construction until the concrete is hard, can be

MECHANICAL CONNECTORS SUCH AS NELSON STUDS, ELECTRIC ARC WELDED TO THE BEAM FLANGES, ARE USED TO RESIST THE ENTIRE SHEAR BETWEEN THE STRUCTURAL STEEL BEAMS AND GIRDERS AND THE REINFORCED CONCRETE IN A COMPOSITE SECTION.



WITH THE STEEL IN PLACE, FORMS FOR CONCRETE POURS ARE SET ON JOISTS WEDGED AGAINST THE UNDERSIDE OF THE UPPER FLANGES OF THE BEAMS.

given. A steel beam without a bottom plate, supporting directly on its top flange a concrete slab of dimensions and strength adequate to develop the steel member in composite action, can be expected to be 15 to 25 percent lighter than a noncomposite steel beam of equal strength. A beam with a suitably proportioned bottom cover plate and without any haunch between it and the bottom of the slab, fully developed in composite action, generally will be 30 to 40 percent lighter than an equivalent steel beam without composite action. With a bottom cover and also a 2 to 4-inch deep haunch between the beam



CONSULTING ENGINEER

WORKMEN NAIL FORMS TO JOISTS PRIOR TO POURING THE SECOND FLOOR OF THE IBM ENGINEERING LABORATORY.

and the slab, the steel saving may reach 45 percent.

If a beam is not shored at one or more points between its ends during construction, it will have to carry the load of wet concrete without benefit of Tee flange. Then design analysis must be based on the steel section alone for load carried before the concrete is hard, and on the composite section for load applied afterward. This substantially reduces the potential steel savings of the composite construction by restricting the composite action to part of the load.

Steel Savings Without Shoring

For example, if the proportions of a composite beam with cover plate are such that composite action applicable to the entire load would save 40 percent of the steel required for a noncomposite beam, composite action applicable only to the last three fourths of the load would save only about 30 percent. With composite action applicable only to half of the load, the savings would be scarcely 15 percent. Since there usually is between one fourth and one half of the total load in place when the concrete is hardening, most projects involving unshored composite beams are penalized roughly half of the steel savings that would be possible if they were shored.

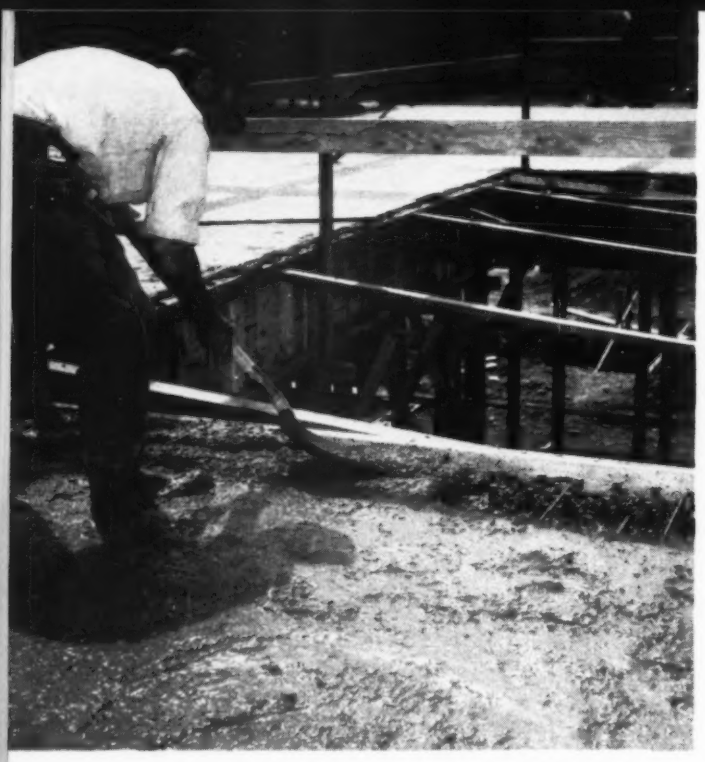
As a rule, composite bridge stringers are not supported temporarily at intermediate points, as would be necessary to produce composite action for the entire load. Such supports would be very expensive at a stream crossing or a high viaduct. For a highway overpass, shores usually would obstruct traffic below. It is quite apparent that the economic success of composite stringers in highway bridges has been based on little more than 50 percent of the steel savings that would be possible if temporary supports were practicable and inexpensive.

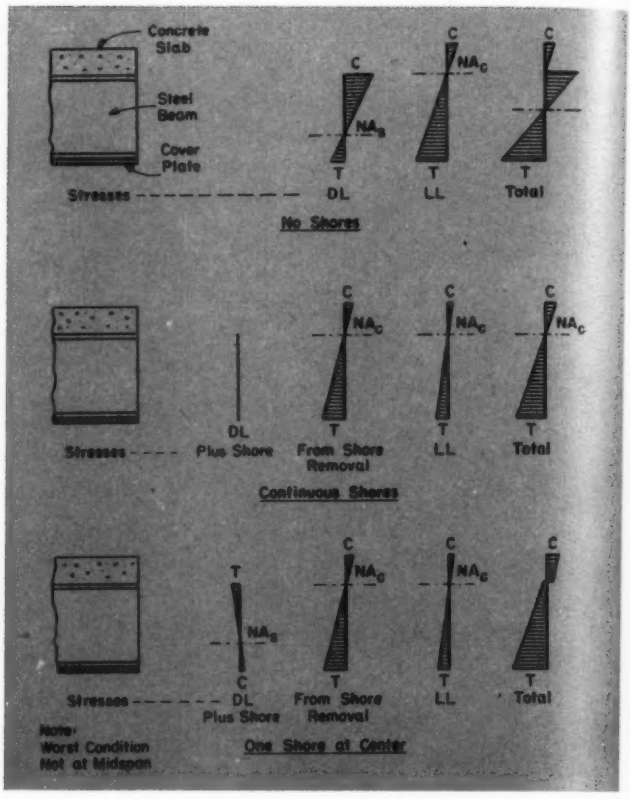
In the field of building construction, however, story heights are mostly within safe limits for shoring with single timber posts or adjustable steel struts. The strength and elastic deflections of the framing in one floor (with respect to loads from shores temporarily supporting steel and wet concrete in the floor above) have to be considered but usually do not pose difficult problems. Generally a single shore at midspan is sufficient to support a composite beam in such manner as to insure maximum steel and concrete stresses no higher than if the temporary support were a continuous wall.

Shims or screws may be used at the shores to camber the supported beams. When this is done, allowance should be made for downward deflection of the shore supports under the load of wet concrete. Also, where shores are placed on mudsills that are likely to settle unevenly, such settlement should be watched carefully when concrete is poured. Corrective wedging or jacking may be needed.

Depth of Construction

Composite beams, with cover plates and without concrete haunches between slab and top of steel, are considerably shallower than noncomposite steel beams of equal strength but have approximately the





SHORING IS AN IMPORTANT DESIGN CONSIDERATION. VARIATIONS IN STRESSES AT MIDSPAN WITH AND WITHOUT SHORING DETERMINE WHAT PART OF THE LOAD CAN BE COVERED BY THE COMPOSITE ACTION.

same stiffness. For example, consider the recently constructed Engineering Laboratory of International Business Machines Corporation, at Poughkeepsie, N. Y. At this project the framed floor areas total 100,000 sq ft, and the framing is composite. Column spacing is 24 by 36 feet throughout, with the girders running the short way. Beams in the long direction are 12-ft apart, occurring at column lines and halfway between. The composite members carry a 4-in. slab of 3000-lb concrete directly on their top flanges, and they are not encased in concrete.

Girder steel for the 24-ft spans consists of 18-in. by 50-lb, wide-flange beams with 5-in. by 1-in. bottom cover plates, 16-ft long. Mean weight per foot is 63 lbs (including shear connectors for concrete bond), compared with 94 lbs for the 24-in. beams that would have been required if composite construction had not been used. For the 36-ft span, 16-in. by 36-lb beams were used, with 6-in. by ⅞-in. cover plates, 28-ft long. Mean weight of the beams is 51 lbs per ft, compared with 76 lbs for a 24-in. noncomposite beam. For typical interior panels, framed as described, the steel per square foot is 6.00 lbs or 33-percent less than noncomposite steel.

Total depth of construction is 23 inches compared with 31 inches for noncomposite construction — a headroom saving of 8 inches in the first story. If 4-in. haunches had been used between the slab and the steel, the composite construction would have been over 50-percent stiffer than noncomposite framing, and the steel saving would have been about 40 percent instead of 33 percent. However, the 4-in. greater depth would have caused some cost increases in the exterior wall other than the mere increase in amount and would have required a concrete haunch 4-in. deep and considerably wider than the beam flange.

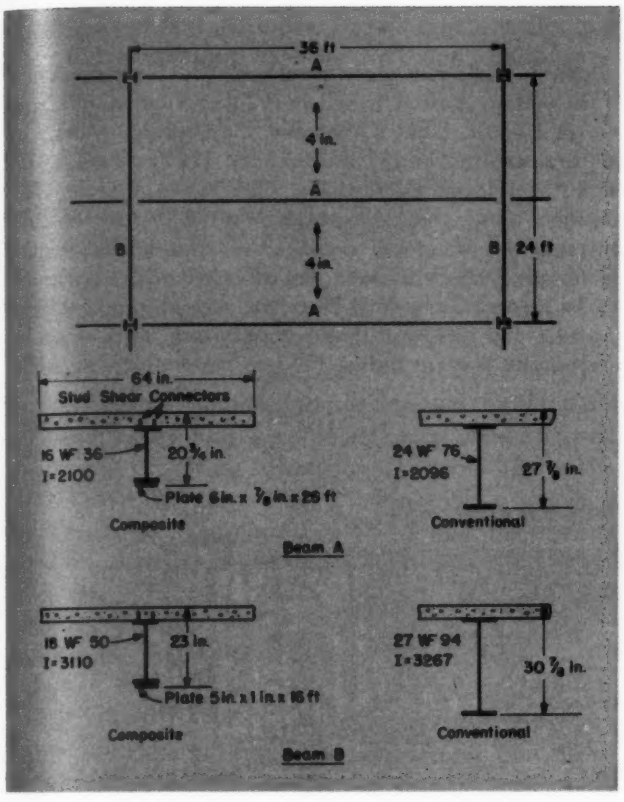
Shear Connectors

As the extent of bond due to adhesion between concrete and steel beam flanges is very doubtful, it is prevailing practice to disregard adhesion in designing composite sections. Instead, mechanical connectors are welded to the beam flanges to resist the entire shear between the concrete and the beam. The most usual type of shear connector to date has been a helix of round steel bar, on which American patent rights expired several years ago. The proprietary system using the helix (or spiral) has been known by the trade name "Alpha System."

Alternate lugs of various forms also were proposed as long ago as 1932, some of them sufficiently simple and rigid to permit dependable analysis, but the only one we have used other than the familiar spiral is the Nelson Stud. This connector is a cylindrical rod, automatically welded at one end to the steel beam flange. The manufacturer calls it a "granular flux filled stud," and it is held and welded by a gun that operates by an electric arc welding technique.

We have designed many highway bridges with composite-beam stringers, all of them provided with "Alpha" spirals. In the building field, our work with spirals includes:

¶ Composite girders with 36-in. wide-flange sections and bottom plates for a 92-ft roof span over the main



STEEL SAVINGS DEPEND ON THE DESIGN. THE USE OF A CONCRETE HAUNCH BETWEEN THE TOP OF THE STEEL AND THE UNDERSIDE OF THE SLAB PLUS A BOTTOM COVER PLATE WILL ADD TO THE ECONOMY.

ballroom of the Statler-Hilton Hotel, Dallas, Texas. ¶ An overseas airfield, now under construction, where about 100,000 sq ft of floor and roof areas are being framed with composite beams, having 14-in. to 18-in. wide-flange sections with bottom plates. ¶ Composite framing for the nave of a church.

In addition, IBM's Engineering Laboratory, constructed last year at Poughkeepsie, has composite framing using Nelson automatically welded studs as the shear connectors. On this project, structural steel bids were based on spiral connectors and studs alternately, and half a dozen steel contractors competed. Most of them quoted on both kinds of connectors with no difference in price, although none of them had had experience with the studs.

Results With Nelson Studs

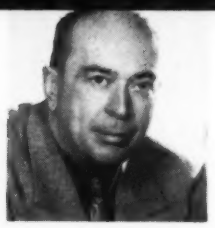
Bethlehem Fabricators, Inc., the sucessful bidder, quoted the complete erected steel frame 4-percent higher for studs than for spirals and took the contract on the basis of spirals. However, that company experimented with studs and found them substantially less expensive than spirals, presumably because of the rapidity with which the studs could be welded in place. The result was that the IBM job was done with stud connectors. More recently, studs were used in platforms of composite construction supporting large syrup tanks at a sugar refinery.

Recently we made a preliminary design for a 12-story medical office building, with composite beams for the longest spans in each floor and under the most heavily loaded columns at setbacks. Another IBM building also is in the preliminary planning stage. It is expected to have a greater area of framed floor than the one recently constructed, and the panels will be larger. The present intention is to use composite framing. For additional information on comparative costs of different connectors, alternate quotations probably will be asked on spirals versus stud connectors on these projects.

Economic Considerations

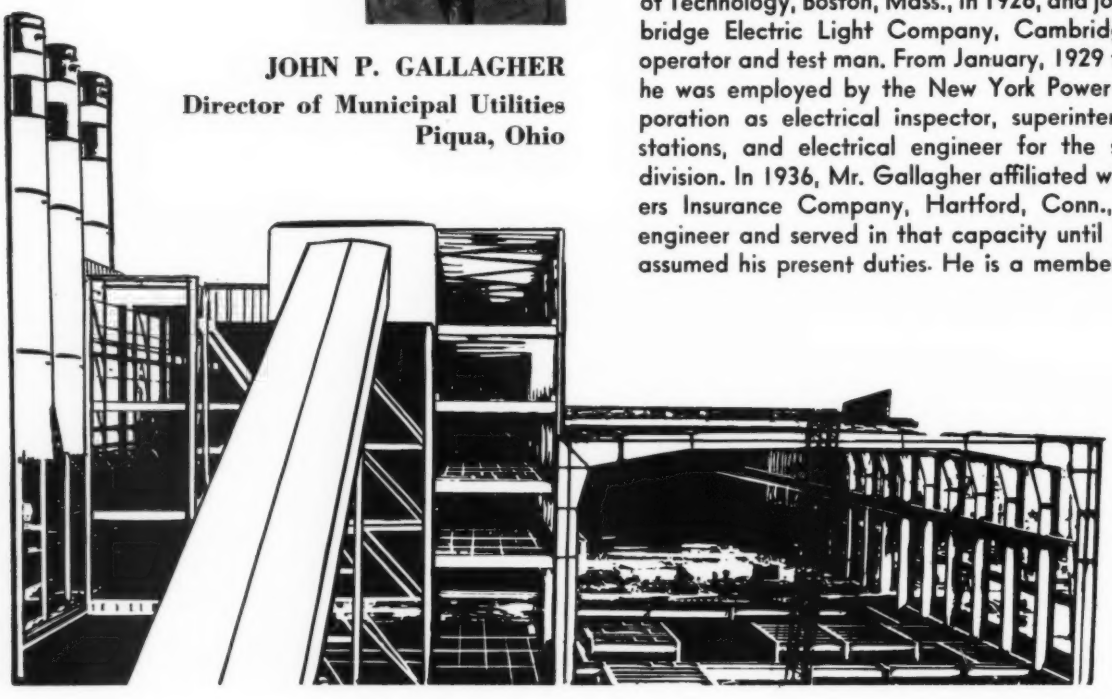
Economic considerations naturally will be the determining factor since it is a mistake to conclude that composite design always can effect a net cost saving when used in place of ordinary design for steel framing under concrete slabs. The impressive percentages of reduction in quantities of steel may not offset the shop cost of connectors and welding cover plates, the field cost of shoring, and the engineers' extra expense in design and checking shop drawings. We know, however, that actual net economies have been accomplished in all of our applications in the building field, and the economy of composite construction for bridge stringers is an established fact.

Our present policy is to use composite design only for beams long enough and carrying enough load to show steel savings worth considerably more than the extra labor and engineering costs. This may result in the use of composite and noncomposite beams in the same building or even on the same floor. Sometimes the extra stiffness with less over-all depth may justify the use of composite design regardless of the cost savings involved. ▲▲



JOHN P. GALLAGHER
Director of Municipal Utilities
Piqua, Ohio

John P. Gallagher graduated from Wentworth Institute of Technology, Boston, Mass., in 1926, and joined the Cambridge Electric Light Company, Cambridge, Mass., as operator and test man. From January, 1929 to June, 1936, he was employed by the New York Power & Light Corporation as electrical inspector, superintendent of substations, and electrical engineer for the steam station division. In 1936, Mr. Gallagher affiliated with the Travelers Insurance Company, Hartford, Conn., as electrical engineer and served in that capacity until 1942 when he assumed his present duties. He is a member of the AIEE.



Evaluating Capital and Operating Costs For Municipal Power Plant Expansions

THE CRITERION for all types of power generating plants is, in the ultimate analysis, identical — the production of electric energy at the minimum over-all cost for the life of the plant or unit involved. Thus, the establishment of a comprehensive base for the evaluation of fixed charges is of prime importance. Operating costs for the normal life of the plant or unit also must be determined on a reasonable and sound basis. With the perpetual growth of power plants, and the increased size of successive units with decreased time between plant expansions, both problems are becoming increasingly difficult. The potentialities of nuclear power merely add to the burden at the present time.

Fixed Charges

Both private and public utility systems must consider various factors prior to the time of each expansion. Fixed charges for the private utility system normally include: insurance; real estate, personal property, and state capital stock taxes; depreciation; return on investment; and federal taxes. In contrast, many public systems follow a basic philosophy which, in general, will not permit a return on investment as such for a nonprofit enterprise. For example, at our Municipal Power Plant in Piqua, Ohio, the fixed charges are: insurance; tax equivalent services (in lieu of real estate, personal property, and state capital stock taxes); and amortization (in lieu of depreciation, return on investment, and federal taxes). But regardless of what constitutes the fixed charges, the need for a basic means of proper evaluation is common to all types of power systems, and it depends on the individual factors involved.

Insurance. Insurance charges are a small, but nevertheless important, part of the fixed charges for all conventional plants. They are a function of current or available rates and the value of the item or items insured. Current rates are influenced by replacement cost and general loss experience. When inadequate experience with a potential hazard prevents proper evaluation, prohibitive rates may result unless catastrophe losses are government underwritten. This means insurance charges will play a significant part in the economic evaluation of a nuclear plant or the nuclear portion of a plant.

Tax Equivalent Services. Free street lighting and other tax equivalent services are a function of government and local policy, and the charges for such items usually represent a substantial percentage of the fixed charges. These services and their associated capital investment are properly chargeable against the power generating facilities, exclusive of the distribution system. This is based on the reasonable assumption that such services and/or capital improvements could and would not be furnished if power was purchased on a wholesale basis.

Amortization. The National Association of Railroad and Utility Commissioners define amortization as, "the gradual extinguishment of an amount in an account by prorating such amount over a fixed period, over the life of an asset or a liability to which it applies, or over the period during which it is anticipated the benefit will be realized." Amortization will cover all charges for principal and interest when all borrowed capital is acquired by issuance of bonds. No allowance need be made for depreciation.

Establishing a Base

One method of approach to the problem of establishing a comprehensive base for fixed charges is to set a weighted life for the plant. This reasonably may be 35 years for conventional power plants. In connection with the nuclear plant, or that portion of a plant useful only with a nuclear reactor, any estimate of prospective useful life on my part would be purely guesswork.

However, the use of the weighted life period for computing unit earning power, and hence fixed charges, is not completely logical. Reference to Table 1*, which provides a selected list of capital recovery factors for uniform annual series annuities at various interest rates, will illustrate this fact. Annual amortization charges at 3-percent interest for a 20-year period amount to 6.722 percent. If the amortization period is increased to 35 years at the same 3-percent interest rate, the annual capital recovery drops to 4.654 percent, or 30.6 percent less than the annual recovery for a 20-year period. But the gross expenditure for the 35-year term (4.654 x 35) compared with that for the 20-year term (6.722 x 20) is 21.16 percent higher.

Using the weighted average life factor in lieu of some lesser period, therefore, will produce more optimistic annual fixed charges. In actuality, the weighted life will place a greater burden on a plant at some point in the future, as it must be acknowledged that each successive expansion, probably at decreasing intervals, will require a greater capital investment due to the increase in the size of the units required to meet evergrowing loads. Possible obsolescence due to technological advances or increased fuel costs also make the use of the weighted life factor somewhat illogical.

Preferred Method

For any given system the preferred treatment is to make a study of unit annual hours of use and capacity factors to determine the active life and aver-

*Abstracted from compound interest tables in *Principles of Engineering Economy,* Eugene L. Grant, The Ronald Press Co.

Table 1 — Capital Recovery Factors for Uniform Annual Series Annuities

Years	Interest Rate in Percent						
	2	2½	3	3½	4	4½	5
5	0.21216	0.21525	0.21835	0.22148	0.22463	0.22779	0.23097
6	0.17853	0.18155	0.18460	0.18767	0.19076	0.19388	0.19702
7	0.15451	0.15750	0.16051	0.16354	0.16661	0.16970	0.17282
8	0.13651	0.13947	0.14246	0.14548	0.14853	0.15161	0.15472
9	0.12252	0.12546	0.12843	0.13145	0.13449	0.13757	0.14069
10	0.11133	0.11426	0.11723	0.12024	0.12329	0.12638	0.12950
11	0.10218	0.10511	0.10808	0.11109	0.11415	0.11725	0.12039
12	0.09456	0.09749	0.10046	0.10348	0.10655	0.10967	0.11283
13	0.08812	0.09105	0.09403	0.09706	0.10014	0.10328	0.10646
14	0.08260	0.08554	0.08853	0.09157	0.09467	0.09782	0.10102
15	0.07783	0.08077	0.08377	0.08683	0.08994	0.09311	0.09634
16	0.07365	0.07660	0.07961	0.08268	0.08582	0.08902	0.09227
17	0.06997	0.07293	0.07595	0.07904	0.08220	0.08542	0.08870
18	0.06670	0.06967	0.07271	0.07582	0.07899	0.08224	0.08555
19	0.06378	0.06676	0.06981	0.07294	0.07614	0.07941	0.08275
20	0.06116	0.06415	0.06722	0.07036	0.07358	0.07688	0.08024
25	0.05122	0.05428	0.05743	0.06067	0.06401	0.06744	0.07095
30	0.04465	0.04778	0.05102	0.05437	0.05783	0.06139	0.06505
35	0.04000	0.04321	0.04654	0.05000	0.05358	0.05727	0.06107

Table 2

Fixed Charges for Piqua, Ohio, Municipal Power Plant

	Mills per kwh	Fixed Charge in percent
1. Insurance—All types	0.005	0.018
2. Tax equivalent services—Free municipal street lighting based on capital expense of $380,000, annual operating cost of $43,000, 3-percent bonds, 20-year amortization, and 1954 plant output	0.950	2.050
3. Amortization—Based on $200 per kw, 50-percent capacity factor, 3-percent interest, 20-year active life	3.112	6.722
Total	4.067	8.790
Total less free services	3.117	6.740

Fixed Charges for Typical Privately Owned Electric Utility

	Fixed Charge in percent
1. Insurance	0.02
2. Real estate and state capital stock taxes	2.00 to 2.20
3. Depreciation	3.0
4. Return on investment and federal income tax	8.0 to 10
Total investment charge	13.02 to 15.22

Methods of Evaluation

1. Insurance (private and public). Insurance is chargeable as a constant for the life of the equipment even though certain segments are variable during the life of the equipment.

2. Real estate, personal property, and state capital stock taxes. This item normally is treated as a straight horizontal line, yet in many instances the real and personal property taxes can be reduced as the station ages. Then the line would have a downward slope with time.

2A. *Tax equivalent services.* This item, like item 2, usually is treated as a straight line, but with increased plant output the line would have a definite downward slope. In actual practice, therefore, items 2 and 2A would be less than the figures shown in the tabulations, which are of necessity conservative.

3. Depreciation. General practice treats this item as a constant throughout equipment life.

4. Return on investment and federal taxes. When depreciation is being taken on equipment it is logical that this item should apply against the undepreciated balance. In actual practice it is extremely doubtful that this percentage is reduced each year or averaged for the life of the equipment. State Utility Commission regulations influence this figure and policy.

5. Amortization, municipal plants. When all funds are acquired through mortgage revenue bonds, theoretically we start with nothing and end with nothing at the end of the amortization period. In actual practice we then have low cost standby service after the write off period, as the only capital charge remaining is prorated on actual equipment insurance charges.

age capacity factor of the unit involved or of a proposed unit. Our studies indicate that on a conservative basis the Piqua, Ohio, Municipal Power Plant can use an active life figure of 20 years and a 50-percent capacity factor for computing fixed charges. It should be noted that our plant is rather unusual as we both retail and wholesale electric energy and also sell high pressure (125 psig) steam for heating and process purposes to local industry. Other plants will have to take their individual circumstances into account in figuring the active life.

Capacity Factor

Basically, capacity factor is the ratio of the average load on a unit to the rating of the unit for the period considered. Assuming 720 hours of operation per month or 8640 hours per year, one kilowatt of installed capacity will produce 86,400 kilowatt-hours in 10 years at 100 percent capacity factor. If the same total output is obtained in a lesser period the capacity factor will be reduced proportionally as follows:

Years	Capacity Factor
10.0	100.0%
12.5	80.0%
15.0	66.7%
20.0	50.0%
35.0	28.6%

After selecting an active life period and capacity factor upon which to calculate the cost of amortiza-

tion, it becomes necessary to estimate the cost of the plant or unit if the study is for purposes of plant expansion. The interest rate available at the time of such expansion also must be determined.

Estimating Capital Costs

Considerable caution should be exercised in assuming the capital cost per kilowatt of installed capacity as consideration should be given to miscellaneous capital expenditures associated with the plant on an average annual basis. These, over the active life of the plant or unit, may amount to a large percentage of the apparent cost per kilowatt of installed capacity in conventional plants. In nuclear plants with no background available it is reasonable to assume a 25-percent increase in the estimated plant cost as a minimum. This figure could readily increase to 50 percent due to desirable constructive improvements dictated by experience during the active life of the plant or unit.

Amortization

The following tabulation is based on an estimated cost of $100 per kw of capacity, 20-years amortization, and 100-percent capacity factor.

Interest Rate in %	Amortization 20 years in %	Mills per kwh
2.0	6.116	0.708
2.5	6.415	0.742
3.0	6.722	0.778
4.0	7.358	0.852
5.0	8.024	0.929

These values can be adjusted readily to individual conditions. For example, assuming a cost of $200 per kw, 3-percent interest rate and 50-percent capacity factor, the amortization charge for a power plant can be computed in the following manner:

$$\text{Amortization} = 0.778 \times \frac{\text{cost/kw}}{100} \times \frac{100 \text{ percent}}{\text{capacity factor}}$$

$$= 0.778 \times 2 \times 2$$

$$= 3.112 \text{ mills per kwh}$$

It is worthy of note that if the same $200 per kw unit is considered for an active life of 12½ years at 3-percent interest rate and an 80-percent capacity factor, amortization charge would be 9.737 percent or 2.817 mills per kwh. This is a decrease of 9.48 percent in the amortization charge per kwh even though both units would produce the same amount of energy during their active life and in spite of an amortization rate increase of 44.85 percent.

Insurance Charges

Insurance charges likewise should be computed on the basis of plant capacity factor, established interest rate, and active life period. Both boiler and machinery insurance provide for suspended coverage so that the cost of breakdown insurance will be greatly reduced after a unit goes into standby service. At the end of the active period only explosion insurance is necessary, although each plant obviously must determine its own insurance policies. Insurance charges for the purpose of determining fixed charges should include not only the amount paid to insurance carriers but also an amount adequate to defray the anticipated expense (on the basis of insurance experience) for self-insured items.

With insurance charges for nuclear plants being an entirely unknown quantity, it can only be stated that this item must be resolved before the relative value of a nuclear plant can be evaluated on a comparative basis.

Tax Equivalent Charges

Equivalent tax charges should be computed on a straight line basis even though these charges, like real and personal property taxes, can be reduced with the aging of the unit. Straight line computation customarily is followed by private utilities for the comparable tax items.

Table 2 summarizes these fixed charges for our Municipal Power Plant, at Piqua, Ohio, in comparison with a typical privately owned electric utility. Pertinent comments on the methods of calculation also are included.

Operating Expenses

Besides the fixed charges, the other major problem is estimating the operating costs on a sound basis. Pressure and temperature evaluation includes the additional capital expense and its associated fixed charge, and it must be compared to savings in fuel not only at today's cost but during the active life of the unit. This will require knowledge of the fuel escalation clauses in industrial or wholesale contracts. Consideration also must be given to the higher maintenance costs with increased temperature and pressure conditions and the nonavailability cost due to forced outages when operation will be on the basis of less efficient units. All of these factors require the use of the predetermined fixed charge for proper evaluation.

Labor Costs

Additional labor costs may be encountered in conventional plants unless detailed consideration is given to equipment arrangement, coal and ash handling, type of fuel burning equipment, and other operating characteristics. In small nuclear units it is very likely, at least in first and second generation plants, that increased operating costs will offset potential fuel savings when such exist.

Fuel Costs

In selecting fuel burning equipment for coal burning plants consideration must be given not only to present day fuel costs but also to anticipated fuel

costs during the active life of the unit. Past experience should be studied for this purpose and both fuel cost and freight rates should be reviewed carefully. For example, the delivered coal cost at Piqua has varied from 15 cents per million Btu in 1934 and 14 cents in 1936 and 1937 to a peak price of approximately 26 cents in 1948. From 1951 to date the price has varied from 21.8 cents to 23 cents, and only during these years has coal been available on a guaranteed Btu basis. During the last 20 years freight charges per ton have increased over 66 percent.

We believe it is reasonable to assume that our delivered cost of coal will increase an additional 50 percent in the next 20 years. This means we must use a fuel cost of 28 cents per million Btu to justify improvement in plant efficiency by utilizing higher pressures and temperatures. The acquisition of high pressure and temperature equipment will, of course, result in a greater capital expenditure per unit of capacity for a given size unit.

Steam Conditions

Naturally, the maximum pressures and temperatures which any plant can use economically are definitely limited by plant size, minimum loads, and capacity factor. To illustrate, our Piqua plant, now operating at 450 psig and 750 FTT, could show a 20-percent savings in fuel at 900 psig and 900 FTT. Yet, on previous units such savings were not possible because of the size of the units dictated by maximum and minimum loads.

Availability

The availability of any new higher pressure steam generating unit or nuclear power unit would be considerably less than that encountered with existing steam conditions. Consequently, serious consideration must be given to this phase of the problem if standby units are to be operated at lesser pressures and temperatures (higher heat rates). The following calculations indicate a very simple approach to the problem of determining relative fuel costs for various steam conditions, and the economic effect of unit availability, which may be reduced when elevated steam conditions are employed.

Evaluation of improved heat rate:

Assume: 20,000 kw unit
80-percent capacity factor
24¢ per 10^6 Btu fuel cost
11,000 Btu per kwh station heat rate

Kwh per day = 20,000 x 0.8 x 24 = 384,000

$$\text{Daily fuel cost} = \frac{384{,}000 \times 11{,}000 \times 0.24}{10^6} = \$1013.76$$

Yearly fuel cost = $1013.76 x 365 = $370,022.40

A 1-percent saving in heat rate (0.01 x 11,000 = 110 Btu per kwh) therefore will provide an annual saving of $3700. At a fixed charge of 8.79 percent, this amount will support a capital investment of $42,093.

Evaluation of economic effect of unit availability:

Assume 11,000 Btu per kwh heat rate, new unit
13,750 Btu per kwh, existing units

Loss of 1 percent availability = 3.65 days per year

3.65 x $1013.76 = $3700.22

$3700.22 ÷ 8.79 = $42,093

$$\$42{,}093 \times \frac{13{,}750 - 11{,}000}{11{,}000} = \$10{,}523 = \text{capital charge}$$

that can be justified by 1-percent availability.

It also should be remembered that cooling water requirements frequently limit total "site" capacity. Even if maximum pressures and temperatures for a given size unit show no net direct financial gain serious consideration should be given to the steam conditions in order to obtain maximum site capacity, and consequently, minimum operating labor charges for a location where cooling water is limited.

Summary

In establishing a base for evaluating a power plant expansion, the following factors must be considered.

¶ Before any economic study can be made for a municipal power plant, fixed charges must be determined. These should be based on realistic active life and load factors.

¶ Insurance charges for nuclear plants must be firmly established before a rational comparison can be made with conventional plants.

¶ Nuclear fuel costs and all charges and credits associated with fuel use, consumption, reprocessing, and fabrication of fuel elements must be determined or underwritten by others before a utility can make a reasonable comparison between conventional and nuclear plants.

¶ Increased site capacity due to decreased cooling water requirements may be the deciding factor in the selection of the optimum pressure and temperature for a given size unit.

¶ Savings in fuel cost for more efficient conventional steam plants and for nuclear plants may be offset by additional capital investment and increased operating costs (exclusive of fuel costs).

¶ Fuel charges for conventional plants should be evaluated for the active life of a plant or unit. For a new unit at Piqua, Ohio, this would be 27.8 cents instead of 22.2 cents per million Btu.

¶ On the Piqua, Ohio, Municipal Power Plant an amortization charge of 3.112 mills per kwh is suggested as being reasonable at the present time. Insurance charges are estimated at 0.005 mills. These charges may apply quite broadly to average municipal power plants.

¶ Total fixed charges at Piqua are considered as being 4.067 mills per kwh or 8.79 percent, using a 3-percent interest rate and an amortization period of 20 years. If lesser interest rates are available at the time of expansion, the fixed charges should be adjusted for the actual interest rate. ▲▲

Consultants Guide to Plant Site Selection

STAFF

SOMETHING OVER one-third of all consulting engineering firms, large and small, are engaged each year to do plant site selection for various types of industries. It is reasonable to estimate that well over half of all consulting firms have been called upon at some time to either select or help select a new plant site. Choosing the right site is no simple matter, and no guide can cover all the subtleties to be considered for a particular industry. It is obvious, for example, that a pulp mill needs plenty of water and power, but the relative importance of transportation, labor, or tax conditions is not so easily evaluated.

The accompanying chart will not relieve the consulting engineer of the necessity for detailed study of the particular conditions necessary to proper location of a new plant. It will, however, give him a quick guide to the factors of most importance for any industry. As a preliminary guide, it should be helpful. It will assure that he will not put off until late in the study, some vital factor that would eliminate one or more of the sites under consideration.

Factors Considered

The first column in the table indicates the importance of locating the plant close to the source of raw material. Where the raw materials are heavy, bulky, or perishable, it is necessary to locate the proposed plant close to raw material sources. For example, perishable foods, forest products, furs and hides, metal ingots, and castings are raw materials that are expensive to ship over great distances.

Labor

The second column indicates the importance of labor supply to a particular kind of plant. This requires careful study, for conditions may vary within the same industry. For example, labor is shown in the chart as important to site selection of a textile mill. Generally speaking, this is true. But if automation is applied to its utmost, labor is not nearly so vital. Therefore, the extent to which the new plant will make use of labor saving equipment is an important consideration. Also, labor does not imply simply the quantity of labor but also skill and price. Again, in the textile industry, there is plenty of skilled labor in New England — probably as much as in the Southeast — but the labor is too expensive. This cannot be determined strictly by wage rates. Hourly wages in the textile industry in the South are not much below those in New England, but Southern textile workers are willing to take much heavier work loads, so that labor costs per yard of production are much below equivalent costs in New England.

Sites

Under the heading "Sites," column 3, are a number of very important considerations. In judging a particular site for its suitability to the industry, the following must be studied.

¶ What is the price of the land?

¶ What is the topography? Is drainage satisfactory, is the structure of the soil such that it will stand the demands to be put on it, and is the area subject to floods, serious erosion, or earthquakes?

¶ Will there be enough land available to take care of future expansion?

Industrial Fuel

Obviously, fuel is more important to some industries than to others. Not only should the present cost of fuel be taken into consideration, but the probable cost of that fuel, or a substitute, in the foreseeable future must be examined. The fact that either oil, gas, or coal might have a price advantage at the present moment does not mean that this will hold true forever.

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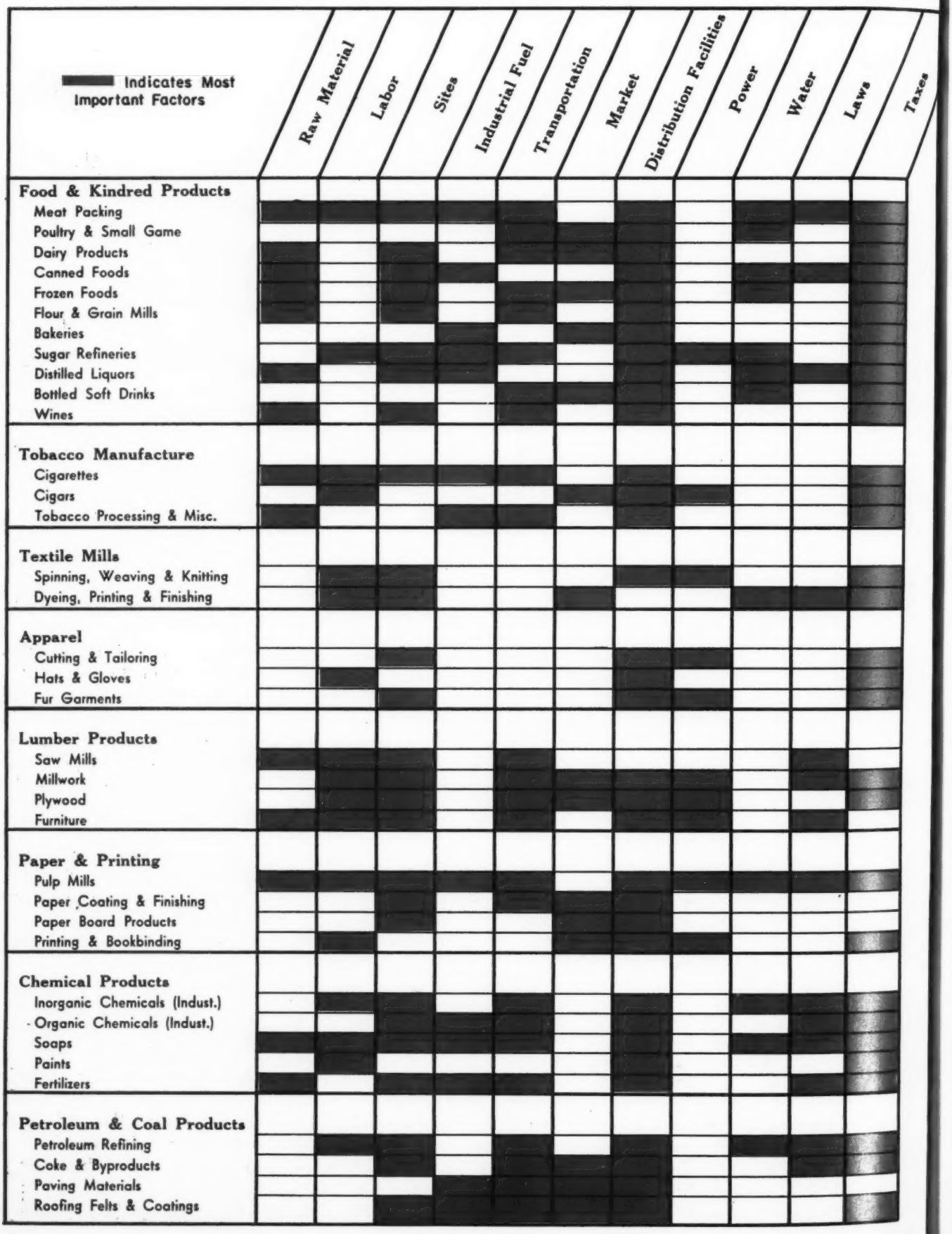
Consulting Engineer Guide



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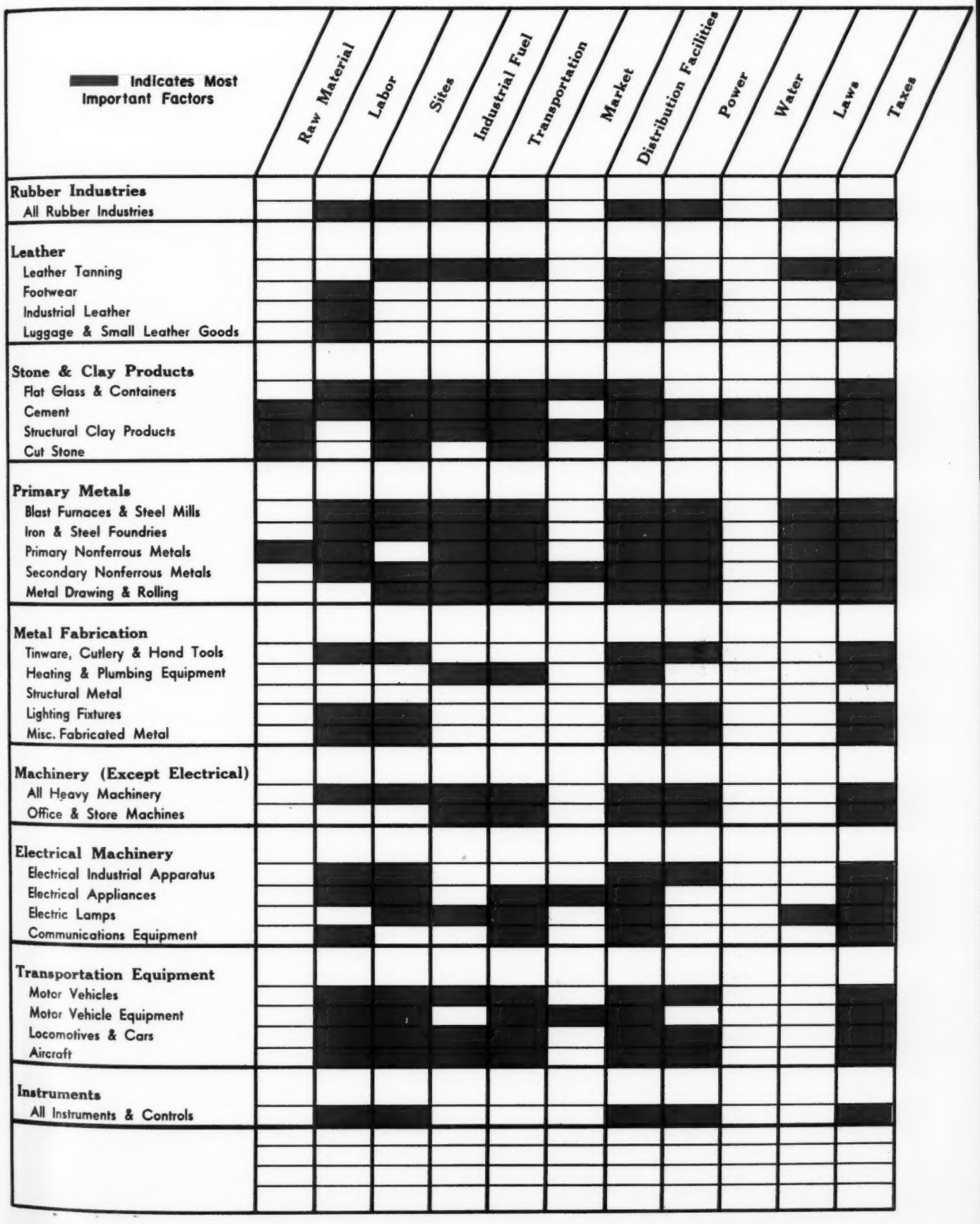

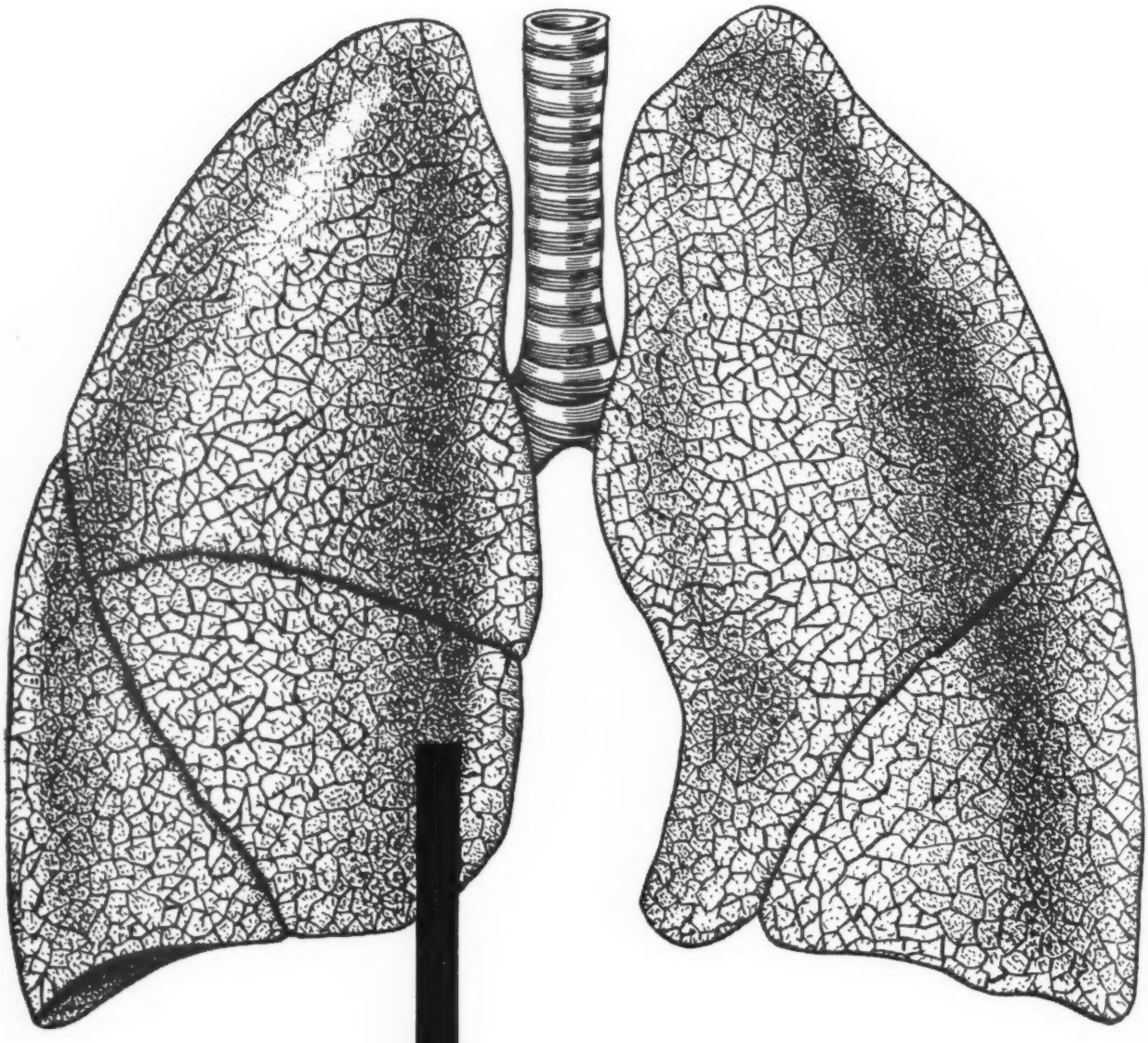

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This article on plant site selection started back on page 61.

Transportation

Transportation is invariably of some importance though not always paramount. Most industrial plants of any size need a rail spur, but good highway transportation is becoming more necessary every year, and water transportation is still an economic necessity to certain industries. Air transportation is seldom given enough consideration in plant site selection. Air express and air freight are widely used for rapid delivery of repair parts and other rush items. Also, air travel is necessary to the proper functioning of many businesses. It is costly for plant personnel to have to travel long distances to get on commercial airlines. Mails are also slower where there is no direct post office contact with an airport serving commercial airlines.

Transportation as a factor in plant site selection should take into consideration not only availability of the various kinds of carriers but the rates charged.

Market

All industrial plants are not set up to serve wide geographical areas. Sometimes they serve only a metropolitan area or a small section of a state. Dairies or small meat packing plants seldom serve very large areas. For industries of this type, the market is very important. A study must be made of the market to see whether there is enough purchasing power or enough demand for the product to warrant the selection of a site in that region.

Distribution Facilities

This item, "Distribution Facilities" should not be confused with "Transportation." This refers to the facilities available for warehousing and storage of both finished products and raw materials. It also involves the availability of financing from banks, brokers, or factoring houses. One reason that particular industries have a tendency to go to locations already occupied by their competitors is the willingness of financial institutions to provide financing in fields with which they are familiar.

Power

There can be no doubt about the importance of power to many industries. Aluminum refining costs are largely power costs. If much electricity is used by the plant, power rates should be checked closely. Rates per kilowatt hour do not tell the whole story. Be sure to check on power factor charges. If the majority of the power used goes into electric motors, power factor charges can be important.

The quantity of power available also should be checked. If the plant is a large one making use of large blocks of power, the local utility may not be able to handle the load. Reliability of power supply is important. In the manufacture of rayon, for example, the interruption of power supply for a short time can cause the plugging of every spinnerette in the plant, resulting in a costly shutdown.

Water

The amount of water available can determine the suitability of a plant site. Minimum stream flow, ground water level, and seasonable fluctuations are all of importance. Also, the chemical analysis of the water can be a deciding factor. To a brewery, water quality is the most important consideration. A power plant is more interested in quantity, so far as condenser water is concerned, but the quality is very important for make-up water. If water must be purchased, price should be studied.

Laws and Regulations

Local laws and regulations have made unacceptable many an otherwise excellent plant site. Air and stream pollution laws are becoming more common and more rigidly enforced. Even where no laws exist, it would be far from smart to locate a plant giving off noxious fumes to the windward of a city. There soon would be laws passed.

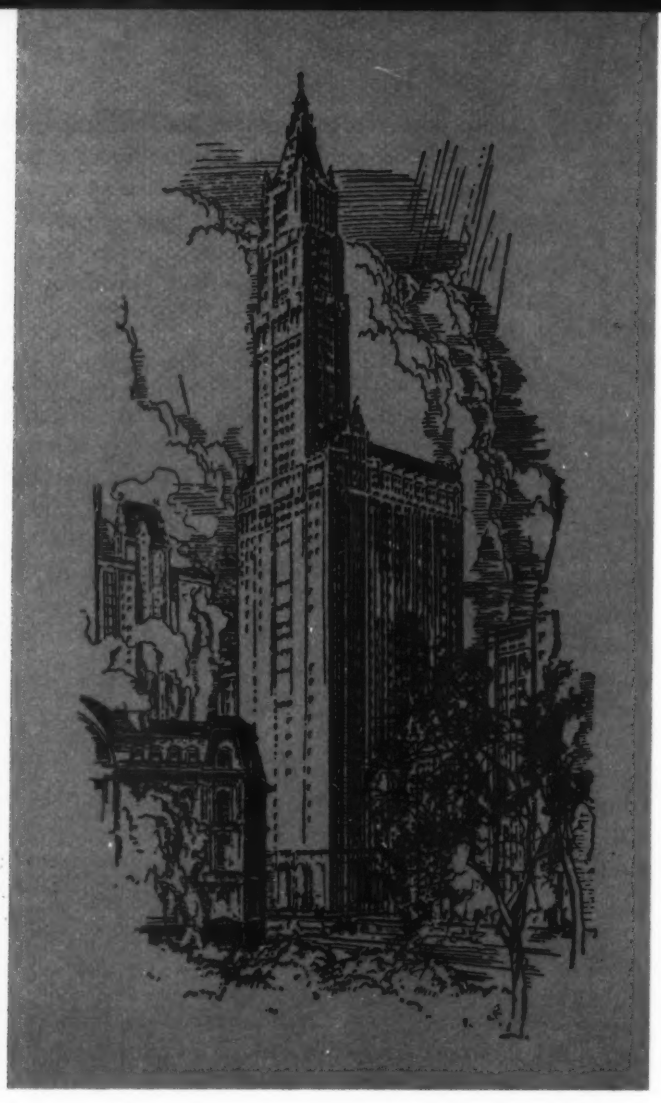
Unemployment compensation laws are worth considering, particularly in seasonal industries. Laws having to do with closed and union shops also can influence plant site selection.

Taxes

Changes in tax rates in the past years should be studies for trends. Note how property taxes for industry are calculated in comparison with property taxes for commercial property and individuals — and how industrial real estate taxes compare to commercial and home real estate taxes. Industry should carry its fair share, but tax structures that throw the heaviest burden on one group or another are dangerous. Any inequity in tax structure is likely to be changed by later city or county administrations.

Other Factors

There are other factors, occasionally of importance, not shown on the chart. For example, climate may be of some interest, though this is seldom too important unless extremes are involved. Living conditions also should be considered. Frequently, key men from an old plant are sent to manage the new plant. If living conditions are poor at the new site, a great many good employees can be lost. Also, if a rural site is selected for a plant employing a lot of people, it may be necessary for the company to build a mill village. This still is expected in some industries. While company ownership of homes and stores is disappearing, many companies still build homes and sell them to employees at cost or less. ▲▲



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A 65-TON foundation girder 8-ft wide, 6-ft deep, and 23-ft long was unloaded from a lighter and dragged to a building site by a 100-ton truck drawn by 42 horses. The year was 1911, and the place, New York City. Sixty-five similar girders followed, one by one.

CP exclusive

At the building site, 66 reinforced concrete piers, 10 to 20 feet in diameter, already were resting on solid bedrock 130 feet below the surface of the street. This was followed by 23,000 tons of structural steel; 17-million common brick; 7500 tons of terra cotta; 1800 square feet of floor tiles; 1,800,000 square feet of partition tiles; 2500 square feet of cut stone; 70,000 barrels of portland cement; 4000 steel doors; 3500 windows; 10,000 feet of metal office partitions, and 7500 gallons of paint. All this together formed one of the best known buildings in the world, rearing its 125,000 tons of material to a height of 785 feet above the sidewalk.

Forty men, toiling in a breath-taking wind for nearly 5 months, laid 40,000 square feet of gold leaf upon the setback roof and the tower, so that men could say, "When the day is dull and things go wrong, look up at the Woolworth tower and smile."

Elevator Service

To reach the gold-tipped tower, 27 Otis gearless elevators toil ceaselessly upward and downward—20 elevators serving the main building and 7 serving the tower. Two of the 7 elevators serve the 53rd floor to a height of 679½ feet, the highest elevator travel at the time of the building's construction.

This elevator design was made possible only because wire type rope had been developed to the point where it could be applied successfully to hoisting of elevators. It was wire rope that permitted the development of the traction type elevator machine; it was wire rope that made high rise elevators possi-

ble; and it was wire rope that permitted the construction of the Woolworth building.

Early Elevator Ropes

Before wire rope came into use, elevator hoisting ropes were usually of Manila hemp. The fibres often were impregnated with plumbago mixed with tallow to hold the strands in position and to provide some lubrication and prevent internal chafing and wear. One such 1½-in. diameter rope, capable of supporting about 2000 lbs, customarily was employed, the fixed end of the rope being attached to the periphery of a wood drum by means of large staples made of ⅜-in. round iron.

To prevent external wear of the Manila hoist rope, it was customary to give the rope a protective covering by "serving" it with a thickness of marline, wound on tightly while the rope was stretched. When this protection wore through, it had to be renewed.

Such ropes were made by spinners who in their youth were "bound out" until they should become of age. A typical indenture provided that, "The lad shall be taught to read, write, and cipher, and shall be given proper moral and religious instructions and also the art of ropemaking. He shall be allowed sufficient meat, drink, washing, lodging and apparel, and all other necessaries, both in sickness and in health. At the expiration of his time he shall be furnished with two full suits of good clothes, one for the Sabbath and the other for working days."

Iron Wire Ropes

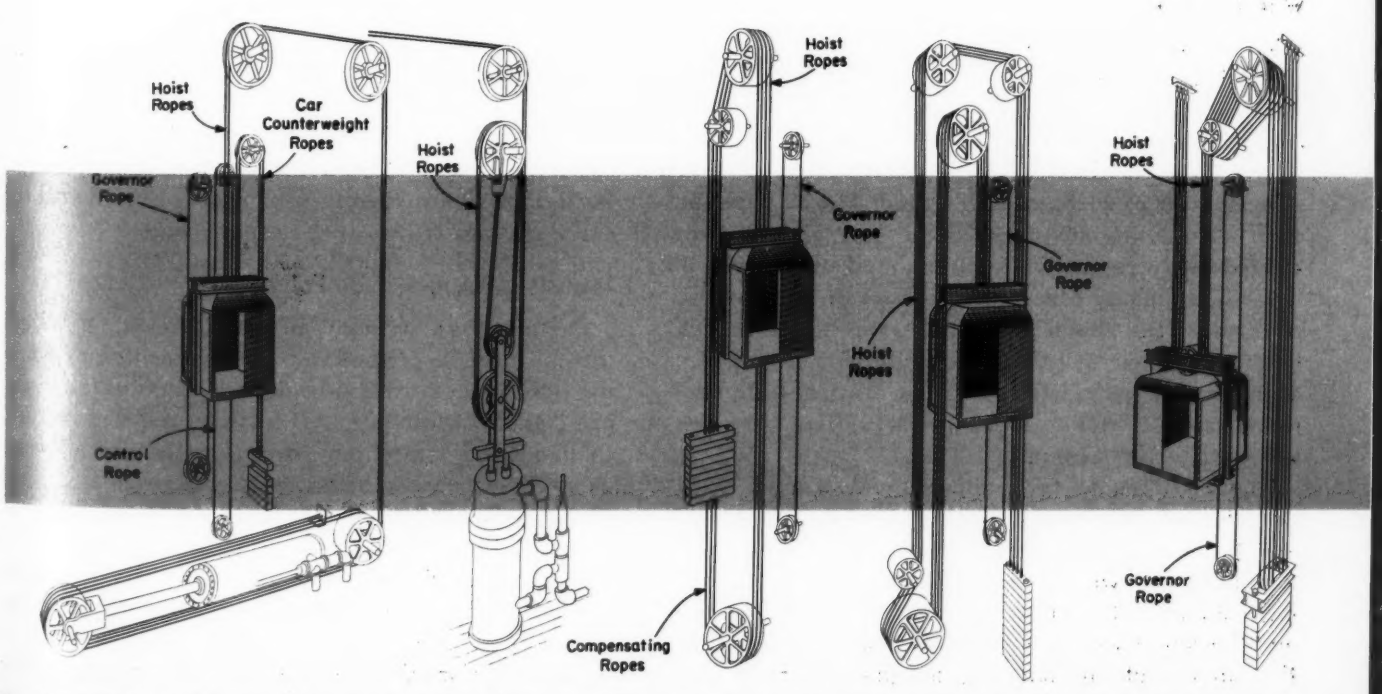
When wire ropes came into use, they quickly replaced the Manila hoisting ropes although the hard maple drums were retained for quite some time. The early wire ropes were made of soft iron on the theory that as the iron wire passed through the forming rolls and the drawing dies, it acquired a fibrous structure that provided the desirable quality of ductility. This permitted the continuous bending and unbending of the rope without breaking as it wound and unwound on the drum or in sheave grooves.

Flexible Iron Rods

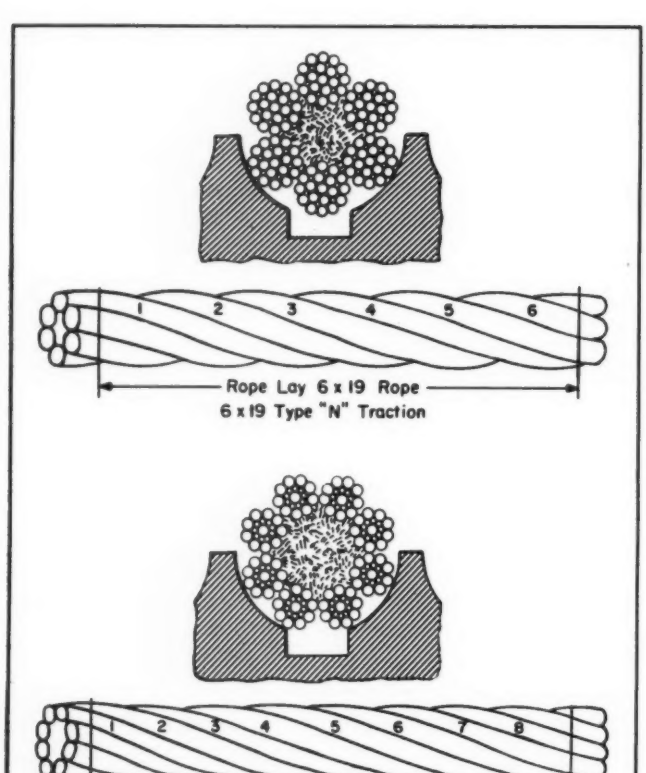
One interesting transition stage was the use of several ⅜-in. diameter flexible iron rods for elevator hoisting. The rods were designed to bend readily around a 4-ft diameter sheave without becoming crystallized or cracked—for a reasonable period of time. They were used with the New England low pressure type of horizontal hydraulic elevator machine. The horizontal hydraulic cylinder was made of a length equal to the elevator travel. The several flexible hoisting rods passed through stuffing boxes in the cylinder head and took the place of the usual piston rod.

Application of regular iron wire ropes for hoisting elevators began with the steam driven drum type machines; with the Hale water balance type drive; and with the steam driven hydraulic machines, both of the horizontal and vertical types using multiplying sheaves. Some of the latter still are operating.

Another interesting roping arrangement was used with an early type of electric elevator—the Fraser type—where two motors, set one above the other, provided the drive. The motors ran in opposite directions. When both motors were running at the same speed, no motion of the car would result; but



L. TO R. HYDRAULIC ELEVATOR WITH HORIZONTAL OR VERTICAL PLUNGER; SINGLE WRAP TRACTION OVERHEAD TYPE ELEVATOR; SINGLE WRAP TRACTION BASEMENT TYPE ELEVATOR; DOUBLE WRAP TRACTION OVERHEAD TYPE ELEVATOR.



DETAILS OF THE CONSTRUCTION OF THE TWO TYPES OF WIRE ROPE GENERALLY USED FOR HOISTING ELEVATORS.

by varying the speed of either motor, the car would run at a rate equal to half the difference in speed of the two motors in the direction determined by the faster motor.

Wire Ropes Today

Today, wire ropes for hoisting elevators are made of steel. One of two types of wire rope construction generally is used, the 6x19 filler type or the 8x19 Seale type.

The 6x19 filler type rope is constructed of 6 strands with 19 wires in each strand. The 19 wires in each strand are all of the same size and are arranged into a center wire, surrounded by a circle of 6 wires, which in turn is girdled by an outer circle of 12 wires. Six smaller size filler wires fill the spaces between the wires of the outer and inner circles. Six such strands are twisted around a lubricant-impregnated hemp center to form the 6x19 filler type elevator wire rope assembly.

The 8x19 Seale type rope is constructed of 8 strands with 19 wires in each strand. The 19 wires are of two sizes and are arranged into an outer and an inner circle with 9 wires in each circle, surrounding a single center wire. The wires in the outer circle and the center wire are of the same size. The wires in the inner circle are smaller, designed to cradle into the spaces between the center and outer wires.

In both types of rope the total strength is so distributed that 57 percent of the strength is in the outer wires and only 43 percent in the inner. Consequently, breaks in the outer wires decrease the strength of the rope nearly 60 percent.

Although there is more metal per unit length in the 6x19 rope, the breaking strength of both types is the same, as shown in the following table:

Rope Diameter	Metal Section 6 x 19 Rope	8 x 19 Rope	Breaking Strength
½ in.	.101 sq in.	.088 sq in.	14,500 lbs
⅝ in.	.158 sq in.	.139 sq in.	23,000 lbs
¾ in.	.227 sq in.	.199 sq in.	32,000 lbs
1 in.	.404 sq in.	.352 sq in.	54,000 lbs

Generally, the 8x19 rope has greater flexibility, resilience, and tractive effort than the 6x19 rope. Furthermore, the 8x19 rope exerts a lower pressure on the sheave grooves, which results in reduced wear of both the rope and the sheave.

Rope Fatigue

Sooner or later steel wire ropes succumb to the common functional disease of all mechanisms, they become tired. The rope fatigue sets in sooner under the cumulative effect of several undesirable and usually avoidable factors.

One factor is the constant bending and straightening of the rope as it passes over the periphery of the elevator driving and deflector sheaves. This can be demonstrated easily by continuously bending and straightening a paper clip; the wire eventually will snap at the bend point. The effect is greatly augmented when the direction of the successive bending is of the reverse type—when the rope is bent during its travel over one sheave in one direction and subsequently bent over the next sheave in the opposite direction. Continuous reverse bending of a paper clip will snap the wire in half of the time.

At faster elevator speeds, the ropes will bend and straighten more rapidly. Where "two-to-one" roping is used, the ropes travel twice as fast as the elevator car. This results in a shorter rope life than on installations where "one-to-one" roping is used and the car and ropes travel at the same speed.

Manual Leveling Speeds Fatigue

On elevators without automatic leveling, where the car must be juggled into a level position by inching the car forward and backward, parts of the ropes are made to wind back and forth on the sheaves and to bend and straighten several times during each stop. This increases the normal bending effect several times and rapidly accelerates the onset of rope fatigue. In addition, sudden starts and stops during the jockeying of the car create higher than normal stresses in the ropes, further tending to decrease the normal rope life.

Other factors that reduce rope life are: improper rope lubrication; poorly adjusted brakes that cause the car to stop too quickly; worn bearings on sheaves

that force the ropes out of line and cause the ropes to rub against one side of the grooves; worn out grooves that result in unequal tensions in the ropes, with higher stresses in some of the ropes; poor condition of equipment that causes undesirable slippage of all or some of the ropes during travel and during stops.

In general, a longer rope life can be anticipated on properly maintained elevator installations that have automatic leveling and one-to-one roping without reverse bends.

Rope Application — Machine Above

Practically all electric elevators installed in the last two decades are of the traction type. The great majority have the machine placed at the top of the hoistway above the elevator car. As the machine rotates its hoisting sheave, motion of the elevator car is obtained by means of the traction, or friction, existing between the ropes and the sheave grooves.

The simplest roping is the one-to-one in which the roping is slung over the driving sheave with the car hanging at one end and the counterweight at the other. With this arrangement, the traveling speed of the ropes is the same as that of the elevator car, and there are only two bends in the roping, both being in the same direction.

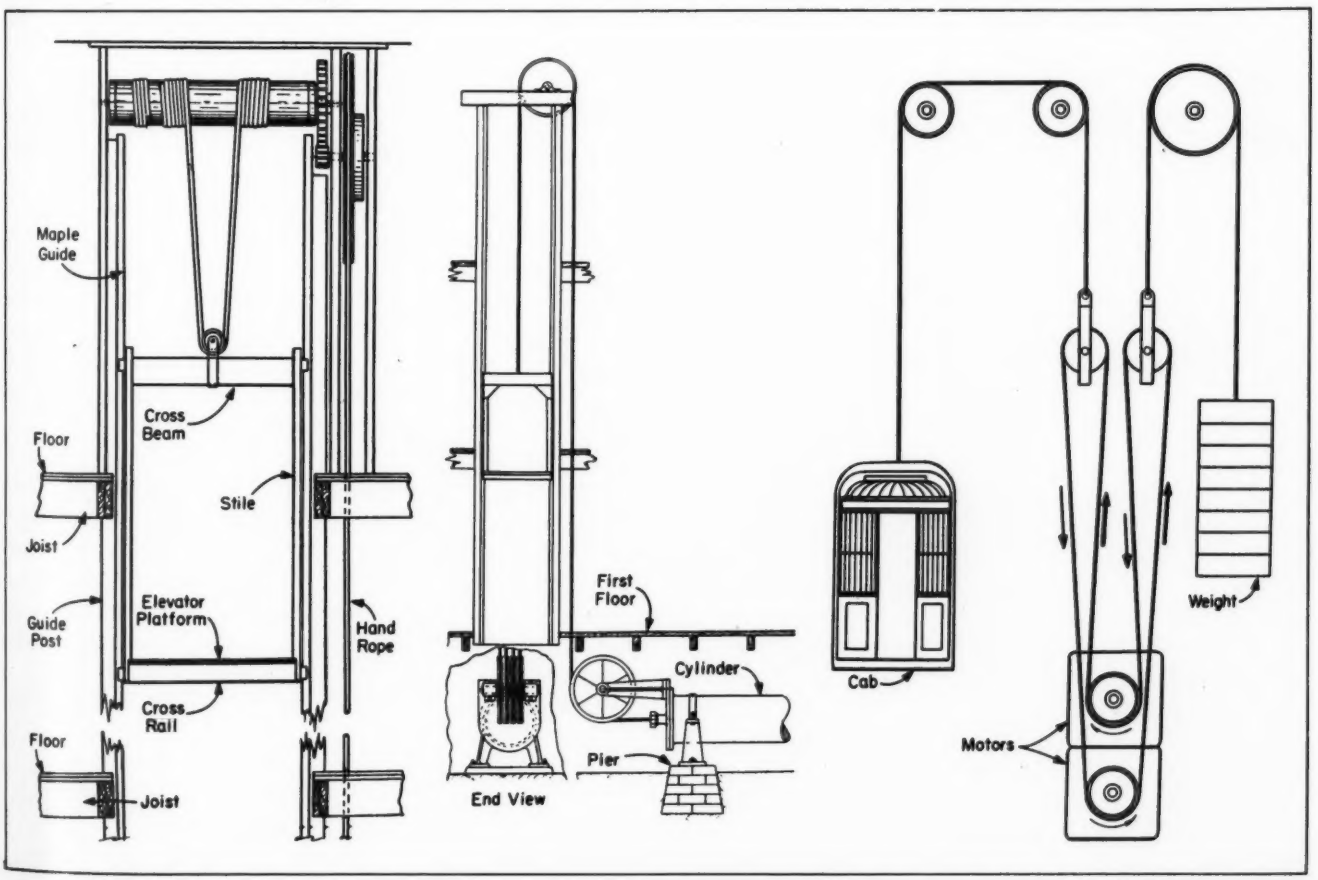
Two-to-one roping requires additional sheaves on top of the car and on top of the counterweight. Any machine capable of lifting a certain load at a certain speed with the one-to-one roping, can lift double the load at half the speed with the two-to-one arrangement. With two-to-one roping the traveling speed of the ropes is twice that of the elevator car. Furthermore, there are at least four bends in the roping, two of the four bends being in the reverse direction. The reverse bends, the higher speed, the additional sheaves, and the extra maintenance make the two-to-one design less desirable than the one-to-one for high speed elevators.

Rope Application — Machine Below

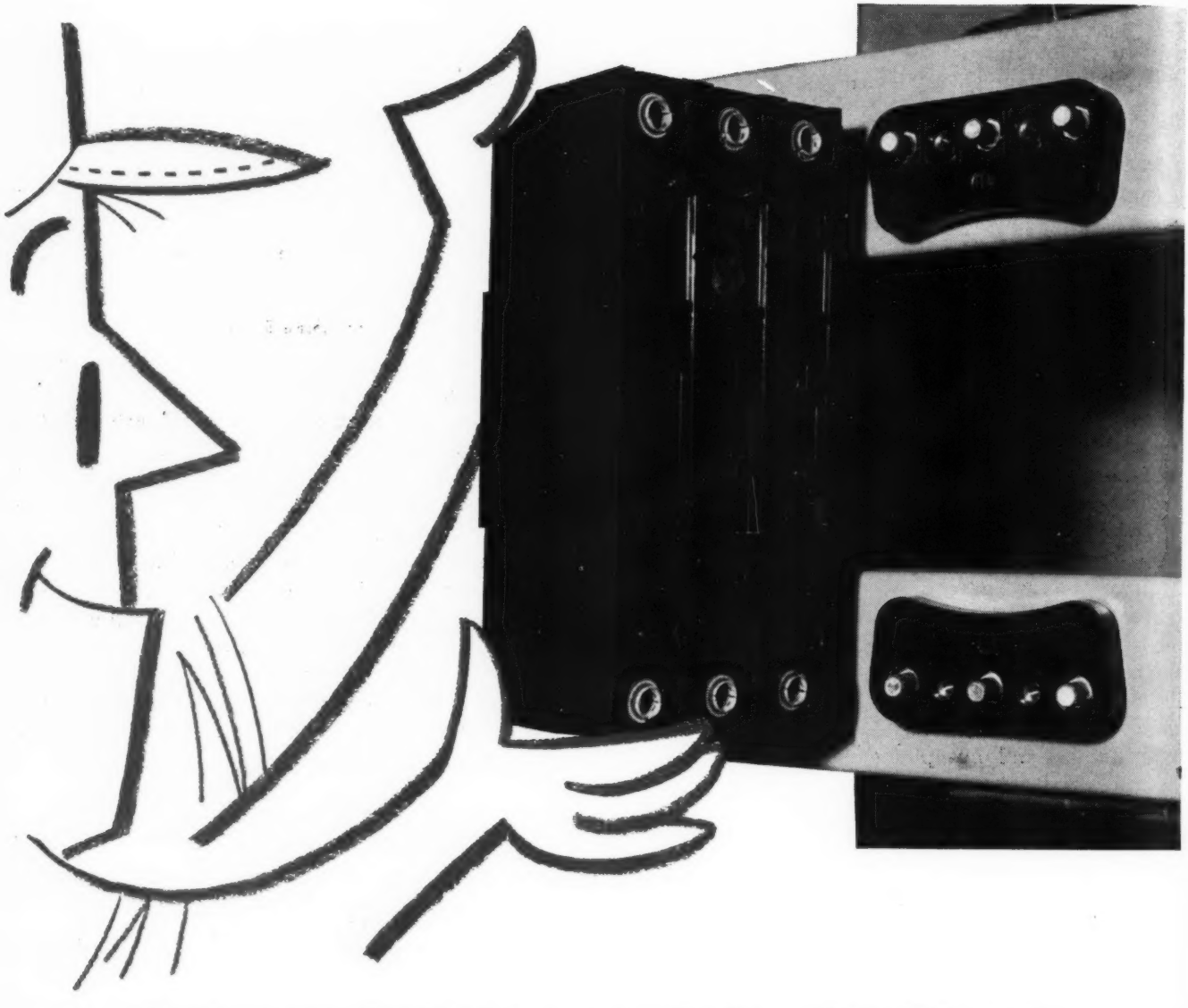
Occasionally, the elevator machine, instead of being placed at the top of the hoistway above the elevator car, is mounted alongside the hoistway at a level below the lowest elevator landing.

Either one-to-one or two-to-one roping can be used for this arrangement. However, the roping is twice as long as that required for the Machine Above design, and reverse bends are unavoidable. Because of these factors, the Machine Below design is less desirable than the more common arrangement with the machine placed above the hoistway.

For most applications, therefore, the most desirable roping arrangement is the one-to-one with the elevator machine located at the top of the hoistway above the elevator car. ▲▲



L. TO R. ELEVATOR WITH MANILA HEMP ROPE; NEW ENGLAND LOW PRESSURE HORIZONTAL HYDRAULIC ELEVATOR WITH FOUR, 3/8-IN. SOLID IRON RODS; FRASER ELECTRIC ELEVATOR WITH TWO MOTORS RUNNING IN OPPOSITE DIRECTIONS.



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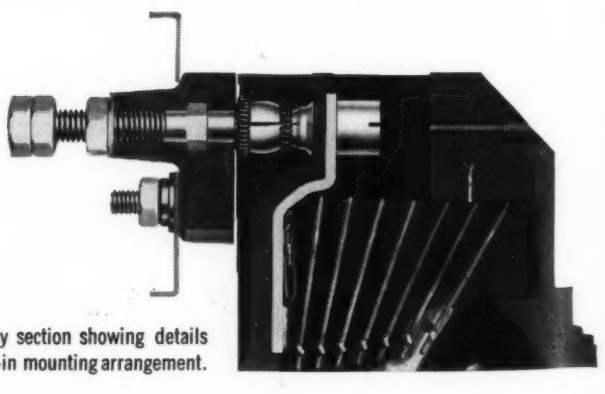

Cutaway section showing details of plug-in mounting arrangement.

I-T-E CIRCUIT BREAKER COMPANY

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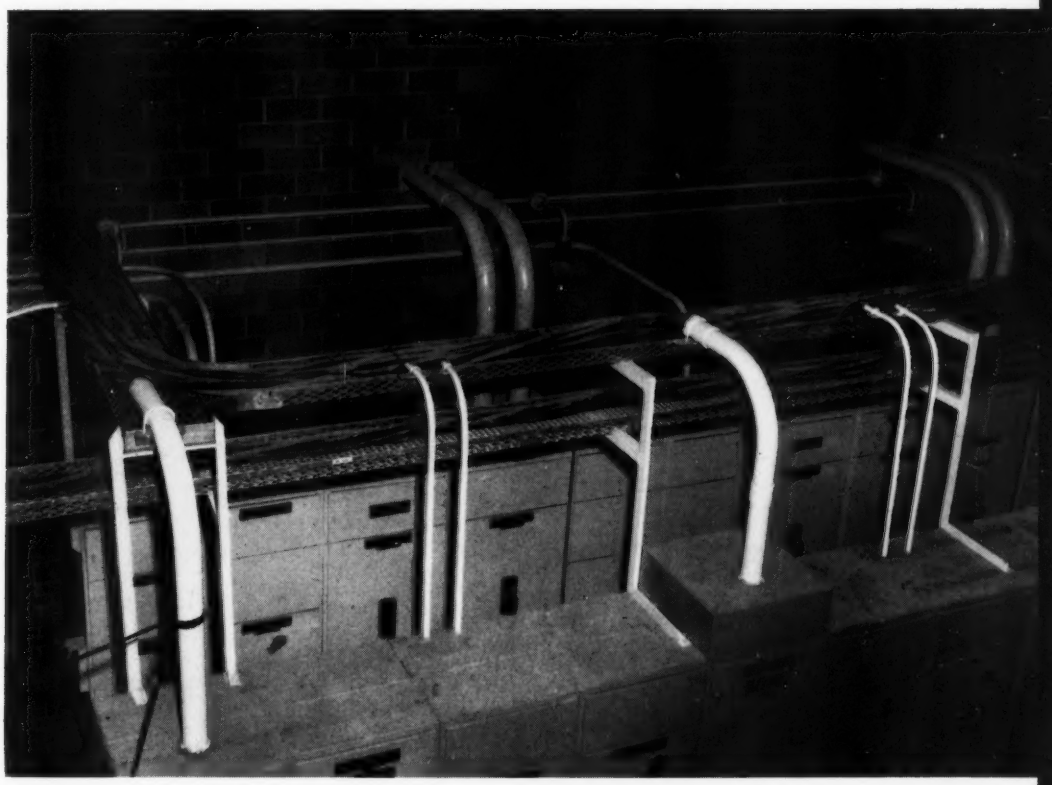


CABLE TROUGH INSTALLATION CARRIES POWER AND CONTROL CABLES TO SWITCHGEAR IN A PAPER MILL. CABLE IS ACCESSIBLE FOR CHANGES OR MAINTENANCE.

Cable Trough Cuts Wiring Costs

MANY CONSULTING ENGINEERS are finding it possible to reduce wiring costs with a relatively new development—cable trough. Metal trough is economical, simple to design and install, saves space, and offers other advantages that for many installations make it the most suitable support for power and control cables. At Burns and Roe, Inc. we have worked with cable trough for more than ten years, so other engineering firms will be interested in a summary of our experience with this type of cable support. Its advantages are still not too well known.

Evaluation of a new system is difficult unless there is some comparative basis by which it can be judged. Since conduit is the commonly used cable support, it can serve as a standard for comparison. For some applications, conduit is the best system of support, and we continue to use it in about 10 percent of our work. Comparisons, therefore, are not intended to apply to all applications, but they will help to clarify the advantages and disadvantages of cable trough. We use the expanded metal trough in preference to solid types because it is less costly, allows a higher cable rating, and it does not collect as much dust. We also prefer and specify trough that has standard fittings for elbows, risers, and dropouts.

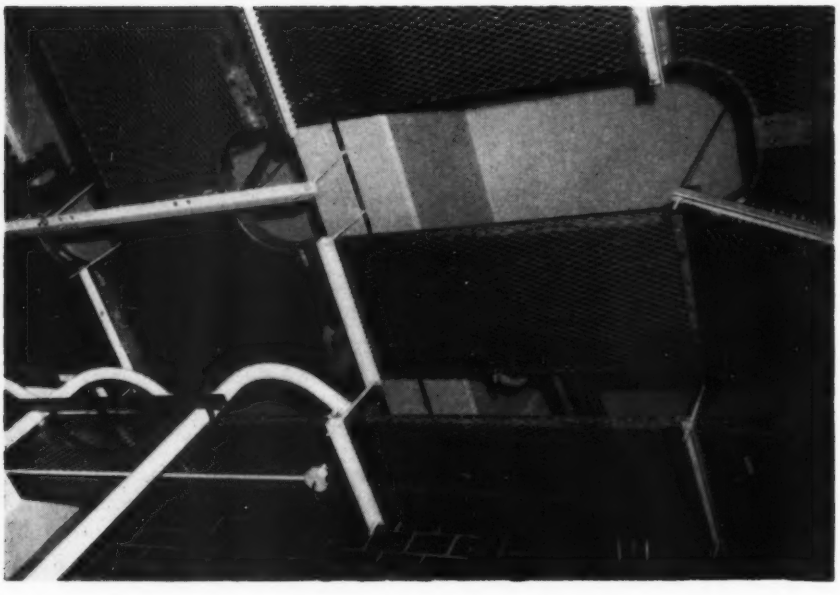
Advantages of Trough

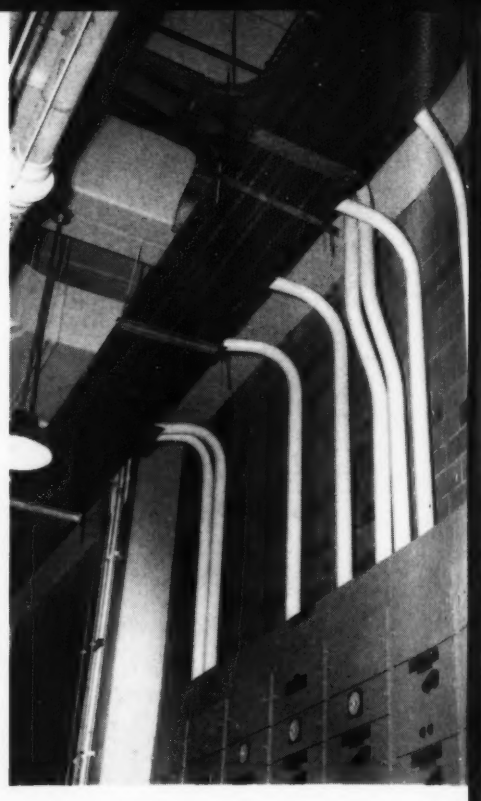
The engineer who is designing a new distribution system will find that systems using trough are easier to design than those using conduit. With conduit, every connector, dropout, or new line must be designed in advance. Changes during installation are difficult and often costly. Trough installations are more flexible, as the trough can be cut and standard fittings inserted in straight runs to allow late changes.

The original design, too, is simpler. We estimate a saving of at least 10 percent in the man-hours required to design a system for a generating station.

Trough simplifies the good use of space near walls and ceilings. During construction, a generating station is a very crowded place, and access to several

THE PHOTOGRAPH BELOW WAS TAKEN LOOKING UPWARD AT AN INSTALLATION OF COPE EXPANDED METAL TROUGH. NOTE THE WIDE VARIETY OF SHAPES AND FITTINGS THAT CAN BE ARRANGED TO GIVE FLEXIBILITY IN CROWDED AREAS.





HERE EXPANDED METAL TROUGH IS INSTALLED ABOVE SWITCHGEAR. A NEAT APPEARANCE IS COMBINED WITH FLEXIBILITY. WHILE THESE CABLES ARE TAKEN OUT OF SIDE, SPECIAL FITTINGS PERMIT THEM TO BE DROPPED FROM THE BOTTOM OF TROUGH.

areas is harder to arrange than is access to one. Since trough saves a great amount of space, it is particularly applicable in power plant design. Moreover, installation of cable is much faster, and this minimizes confusion and crowded conditions.

With regard to space requirements, we would estimate a saving of about 50 percent over conduit. The saving is even greater if more than two layers of cable are laid in the trays, but we do not recommend this practice unless current ratings are very low and overheating is not a problem. These savings are not fully realized with more than one run of trough, as working room must be left between the levels of the trough.

Space becomes most important when cuts must be made through walls or floors and when approaching control panels. This holds true for vertical as well as horizontal runs.

Savings for the Client

The advantages of trough over conduit will be immediately apparent to the consulting engineer's client. Comparative costs can be broken down into: (1) cost of installation, and (2) cost of material. Installation cost figures are determined almost exclusively by the time involved. A trough system can be installed in much less time than is required for installation of conduit of equivalent capacity. Probably the savings in installing the cables themselves are even greater, as cable is simply laid in place in the troughs while it must be pulled through conduit — generally a time-consuming process.

On an average, we would estimate an actual saving of about 25 percent in installation costs—a substantial figure, since this is the largest part of the cost of the project.

Trough Types

It is well to point out that there are differences among trough systems, too. Some types require nuts, bolts, and washers for each connection. For example, one old system required as many as 50 different pieces for each connection of 24-in. trough. The new model by the same manufacturer uses a fin-type coupling that secures the connection as if it were a nonmovable hinge. The fittings are welded to the trough itself so that two pins and a bottom plate are the only pieces needed for a connection.

EITHER CONDUIT OR EXPANDED METAL DROPOUTS CAN BE USED TO CARRY CABLE TO POINT OF USE.

Thus, the elimination of 47 pieces further reduces the time required for installation, and effects a savings of something better than the 25 percent estimated for installation.

Materials savings are also significant. A 10-ft run of 24-in. trough weighs 520 lbs less than 10 feet of the equivalent capacity of 4-in. conduit. It is apparent that there is a saving of more than a ton of steel in every 40 feet of cable supported by trough.

Electrical Properties

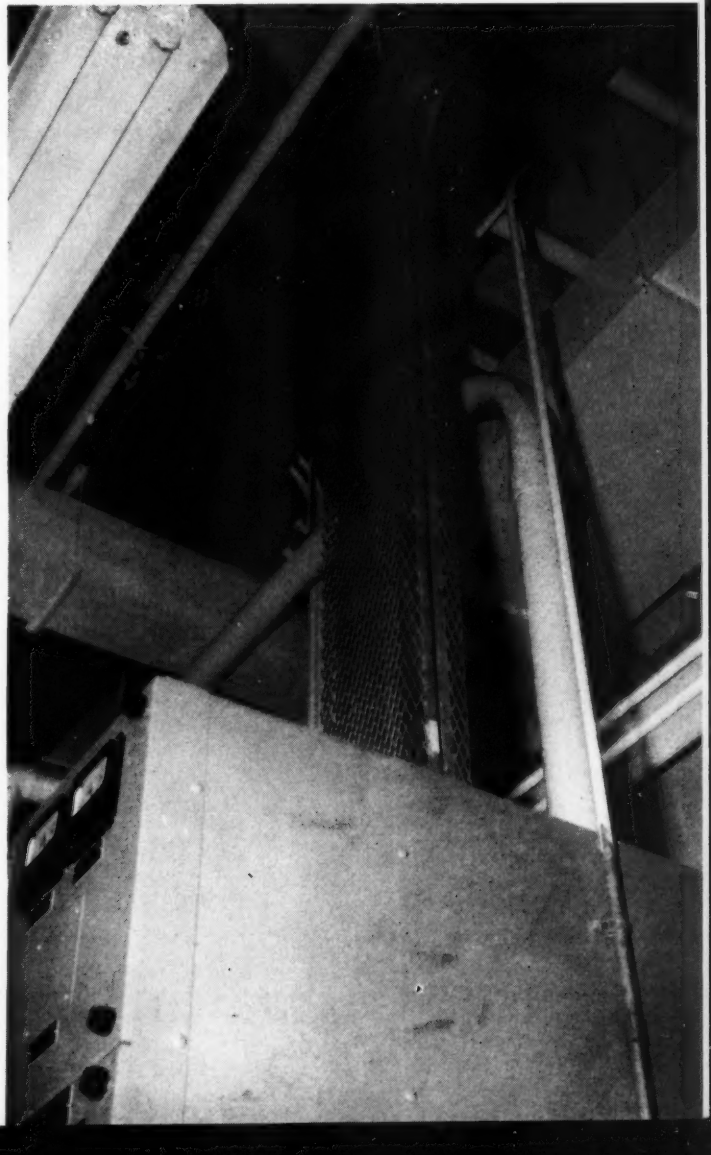
The electrical properties of cable in trough are superior to those of cable in conduit. We allow a free air rating if no more than two layers of cable are laid in expanded metal trough. The rating in conduit is approximately 0.65 if only 4 cables are used — even less if the number is greater. This means an increase of 20 percent in current carrying capacity for the same cable if laid in trough. For similar current capacity, smaller and less expensive cable can be used if the system is trough supported.

If the trough is considered a raceway instead of a support, the electrical properties of the trough itself must be considered. Tests seem to show conclusively that the trough is a sufficiently good conductor to activate circuit protective devices in event of a ground fault. It is conceivable that some trough connections might not be electrically tight, but we have not experienced any trouble in several hundred installations and have not had to require bonding across section joints. This would indicate that the electrical properties of the two systems are approximately equal.

One advantage of trough for some installations is its ready adaptability to later modernization and expansion. There are few installations where the designer is certain that there never will be a new circuit needed or a change made in existing equipment requiring new cable. Addition of a new circuit or even several new circuits is a simple matter with trough, as the new cable simply is laid into existing trough. It is not good practice to pull new cable through conduit in excess of 40 percent of the cross-sectional area. The alternative is to run more conduit, and this is always costly.

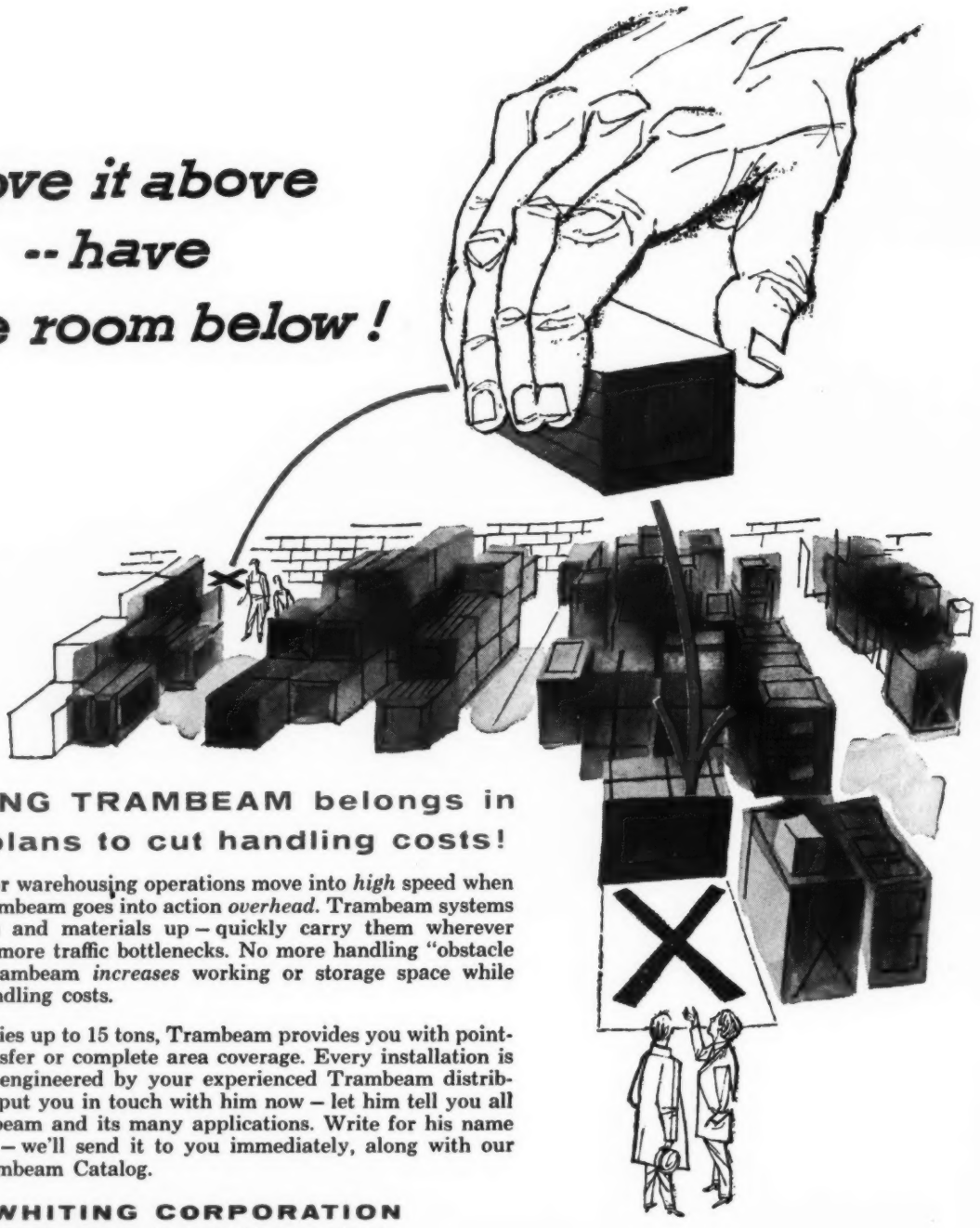
The cables themselves are treated better in trough than in conduit, since they generally are laid in place instead of being pulled. They are readily accessible for inspection, repair, rerouting, and replacement. There also is a higher salvage value to the cables. It is true that trough will not localize trouble, but a major fire will damage the cables no matter where they are installed.

Trough, of course, cannot always be used; highly explosive atmospheres require completely protected systems. There are a few other special situations, as well. However, cable trough is entirely suitable for utilities and for most industrial applications. Where it can be used safely, our experience indicates that its advantages over conduit are considerable. ▲▲



CLOSE-UP OF A COMPLETELY CLOSED DROPOUT FOR HIGH CONCENTRATION OF POWER AND CONTROL CABLES GOING TO SWITCHGEAR PANEL CABINETS.

Move it above -- have more room below!



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Consultants Can Hire The Men They Need

STAFF REPORT

THERE MAY BE some question as to whether or not there is an actual shortage of engineers. If all registered or graduate engineers were doing engineering work, there probably would be a surplus rather than a shortage. The fact is, however, all of these engineers are not working in engineering. Many of them can make more money in sales, management, or other types of nonengineering work. So we have a peculiar type of shortage that is the result of relatively low pay for engineering work rather than a shortage of engineers, themselves. Any firm that can afford to match the salaries paid "sales engineers" would find a good-size line outside the office in the morning.

Shortage of Young Graduates

However, there is a very genuine shortage of young graduates. The going rate for the average engineering graduate this year is better than $400 per month. The large manufacturing companies are competing for these men to such an extent that it is next to impossible for consultants to stand much of a chance in the market place. Certainly this is true for the smaller consulting engineers.

Whether the shortage is based on salaries consultants can afford to pay or on the competition for the young graduates by large manufacturers, the fact remains that consulting offices are having a hard time finding the men they need. This is another problem to add to the many facing consulting engineers in private practice, but it is by no means an insolvable one.

Using Technicians

It has been suggested that many engineering jobs can be reclassified, slightly changed, and handled with ease by technicians instead of engineers. There is no doubt that this is true in the engineering departments of many large and small manufacturers and in engineering departments of government where the work is largely repetitious. There is certainly no point in having graduate engineers sit at drafting boards all day tracing drawings or preparing lists of materials. That type of thing can be done by anyone who has had a high school drafting course. Similarly, engineers are hardly needed in the checking rooms of state highway depart-

ments where cut and fill calculations are made hour after hour. On the other hand, there are very few jobs in a consultant's office that can be handled by men who are less than full engineers.

Most drafting room jobs in consultants' offices involve a great deal more than repetitious tracing. In fact, some of the most important, straight engineering work is done on the board. Design work is largely board work, so in a consultant's office, not only do the men on the boards need to be engineers, they need to be good engineers.

Recent interviews with consulting engineers in a number of cities, in both large and small offices, brought out the fact that consultants' offices must be staffed with engineers, not with technicians. Even the larger offices had found it impractical to substitute technical draftsmen for engineers in any but a few jobs. There is not enough work for a man whose technical skill is limited to tracing drawings in ink or copying data from catalogs.

This situation is the cause of some confusion in the hiring of engineers who have had experience only in industry. When they are interviewed by a consultant and are told that they will be assigned to a drawing board, they quickly decide that the job is not good enough for them. They feel that they have passed the stage where they can be hired as draftsmen. Even recent graduates have the feeling that they are too far along to accept a job as a draftsman. They do not know what board work in an engineer's office is. They will turn down a good offer from a consultant in order to take a "more responsible" job in test engineering or sales with some manufacturer. If they only knew it, the job on the board in the engineer's office involves much greater use of their engineering knowledge.

If, then, the shortage of engineers is to be relieved by putting more technicians to work on jobs currently held by engineers, this will have to be done by manufacturers and government. For the most part, they do not fit into consultants' offices.

Hiring New Men

Probably the hardest men to hire are good, middle age engineers with better than 20 years experience. A top-grade employee engineer in his 40's or early 50's should be making between $10,000 and $15,000 a year. If you were looking for such a man, the problem would be largely one of money. If you are willing to pay $17,500, you should be able to hire plenty of men—good men. If your limit is $8000 or $9000, you will have to take a younger man or a man with fewer talents. Suppose that you are looking for a good man—a man with 10 to 20 years experience. According to national averages, he should be now making about $9000 to $12,000. If you offered $13,000, you would wonder who thought there was a shortage of engineers.

The young engineer with less than 10 years experience should be making between $6500 and $8000. Any salary over $8000 would find good men aplenty.

Young graduates straight out of school are now getting $4500 to $5500 and are scarce.

The simplest way to get the men is to beat the going salary scale and pick the best men from among the applicants. This method is exactly the one used by many manufacturers. The cost of engineering work in many manufacturing plants is but a small fraction of the cost of the end product. Therefore, they can afford to increase engineering salaries for a limited number of specific jobs without increasing the cost of the product to any extent. Consultants have a different problem. Salaries and other costs that are charged directly to an employee can amount to well over 75 percent of the fee for a project. Any increase in salaries represents a major increase in operating costs, so few consultants can afford the simple solution of offering the highest salaries to get the men they need. Other, more difficult methods must be used.

Older Engineers

One possibility is in the use of older engineers. While there are some disadvantages in hiring men over 55, there are many experienced engineers in this older age group who are looking for jobs and are willing to take the going salary rate or even less. Placing an ad in a local newspaper or placing a request with a technical employment agency will get surprising results if it states that the employer is looking for an engineer "over 55." Also, the "Plus Forty" organization maintains a list of available older engineers. Hiring older men requires very careful screening of the applicants, but some of the best engineers in the country are available in this age group and at moderate salaries.

All too many consultants think of the disadvantages of hiring older men and forget the advantages. They forget that these men are likely to have fewer conflicting outside interests than younger men and are therefore more interested in their jobs. Also, the older man is less interested in the interoffice politics that come about through the scramble of younger men to get to the top.

It is important to know, when hiring older men, why they want to change jobs. Many of them have very good reason. Frequently, such men have worked most of their life on construction projects or on other work that required more traveling or more activity than they relish in their later years. They are looking for office jobs and would welcome design work on the board. These men are real bargains for the consultant's office.

If the needs of your office demand a younger man, a man between 30 and 50 with a considerable amount of experience, there are two major sources of supply—large manufacturers and government. There are many good engineers working for man-

ufacturers or for government who would rather work in a consultant's office. They are not as easy to hire, however, as men who are either younger or older. These men are at an age where they are raising families and have children in school. They are reluctant to change jobs because they are greatly interested in personal security. Large manufacturers and government offer security, while consulting firms do not always have the best records for employee turnover. These men usually have to be convinced that the job offered is permanent and that there is opportunity for advancement.

Young Engineers

The younger men, those in their 20's offer another bargain for the consultant. They can be hired for very little more than a graduate with an unrolled diploma. Since starting salaries are so high for new graduates, there is a tendency for raises to be small and come slowly for the first few years. Generally speaking, the young engineer with about three years experience can be hired for just a few dollars more than the new graduate, and he is likely to be a much more valuable employee during the first year. Also, these men are not so vitally interested in security as are those 10 or 15 years older. The problem here is to convince them that design work is not below them. Once they know what is meant by "design work" they will recognize it as work they would like. Here, the best approach is through the papers in industrial cities or through the Engineering Societies Personnel Service.

Young Graduates

Sometimes, of course, the young graduate is the man needed. If so, the consultant must be prepared to pay $400 per month or more, and he must compete in a tough market. The large manufacturers are spending a lot of money trying to hire graduates and it is unlikely that any but the largest consulting firms could make much of a showing at the spring contests where representatives of manufacturers go after engineers as if they were college coaches going after high school football stars.

This is not to say that consultants could not get their share of these graduates. They could, but hardly by using present employment methods. Corralling young graduates could be done as a cooperative action instead of by the individual firms. This is an excellent project for consulting engineer groups. A committee could be appointed to visit the engineering schools. They would arrange to visit the colleges in the area perhaps four times during the school year. They would tell the students what the consultants are and what they do. They would explain the types of work done by the firms who are members of the association, and they would tell the students of the type of work they, themselves, would do when they went to work for a consultant.

When the time came to sign up the students for employment, the committee would have a list showing just what consultants had openings and what types of jobs and salaries were available. Those students who were interested would then have appointments made with the partners or principals of the firms in which they were interested. Properly handled, this type of program would secure for consultants not only their share of the young graduates, but consulting firms also could get the best men from each class.

The important part of the program would be the educational aspect. Most students have no idea what a consulting engineer does. This would have future as well as present value, for many young engineers go to work for manufacturers or government and then become dissatisfied because of the many nonprofessional aspects of their work. Even then, after several years experience, they do not know what a consulting engineer is. Had they been told in school, many of these men would go looking for work with consultants when they made their first job change.

Consultants have something that all engineers are after. The representatives of manufacturers, when making their pitch to the students, emphasize the professional aspects of the jobs they have to offer. They go through a spiel that, if analyzed, would come very close to depicting conditions of work in a consulting office rather than in the engineering department of a manufacturer. These men know that the young engineer is looking for a professional environment, and they do everything possible to make their own engineering departments look like the operations of a group of engineers in private practice. Most of these students would prefer the real article.

Eventually, most engineers decide that they would like to be with a firm in private practice. After many years they recognize that the place to find the professional atmosphere is in the consulting firm. But it takes them all too long to learn this.

Employee Pools

There is another very practical way to solve some of the consultants' employee problems — the employee pool. Currently, the only successful employee pool is operated by the New York Association of Consulting Engineers. The Missouri Association is now making plans for a similar group. The idea here is for any consultant who has a temporary excess of men to list them with the pool. Then, any other member of the association who needs men gets them from the pool. The men stay on their regular employer's payroll, and receive their regular salary from him while on these temporary assignments. Such a pool also can act as an employment service and search for new men.

With well directed group action, it would not be long before consultants would find the "shortage" had disappeared. ▲▲

News for the Consultant

More Headroom at Small Cost Designed into Plant Buildings

Newer production methods and machinery have increased the need for more headroom in modern manufacturing plants. The engineers' problem is to provide this extra space at a minimum cost for new construction or remodeling of existing buildings.

As part of a multi-million dollar expansion program, Republic Aviation Corp., of Long Island, purchased a neighboring factory building, planning to use it for limited assembly-line production of experimental aircraft. Maximum height under the arched roof was 16 ft, 11 ft less than the space required. Instead of removing and replacing the old roof, Albert Kahn Associated Architects & Engineers recommended erection of a rigid frame type external structure from which the roof could be suspended. This allows removal of the lower roof chord, and provides the extra 11 ft of headroom.

Seventeen steel frames were erected over the existing roof at evenly spaced intervals. Each frame was designed to support 2000 kips. The four 1¾ in. steel rods hung from each frame pierce the roof to support the two horizontal steel channel beams that sheath each side of the upper horizontal steel wood chord. The lower wood chord was no longer necessary, since the roof is now suspended from the frame instead of resting on the walls.

Use of high strength bolts for connections in the external framework reduced erection time and saved an estimated $7 per ton of steel. The bolts used are manufactured by Russell, Burdsall & Ward Bolt and Nut Co.

The architect-engineering firm of Stiles and Robert Clements, of Los Angeles, have designed a new plant for Rose-Derry Co. utilizing welded girders built up from steel plate to 190 ft lengths for maximum headroom with a minimum of steel.

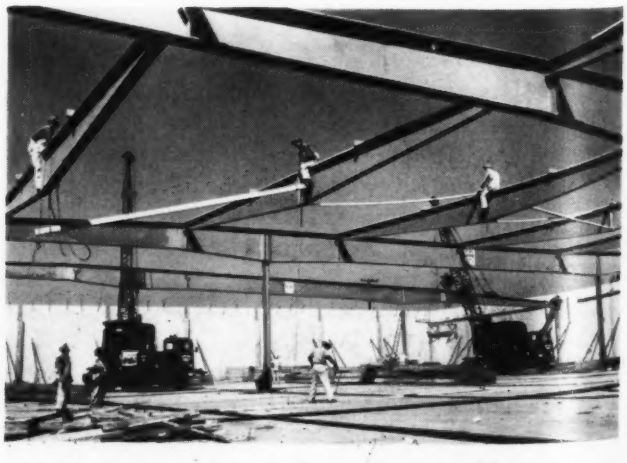
Six-ton transverse girders provide the extra headroom between supporting columns by using stress patterns on each beam, eliminating part of the depth required with use of rolled beams. The shape also reduces weight and cost. Double-tapered cross members, also built up from plate, allow extra headroom between transverse beams. Girders were fabricated from Kaiser Steel Corp. plate.

Vibration of New York Buildings Measured With New Gyroscope

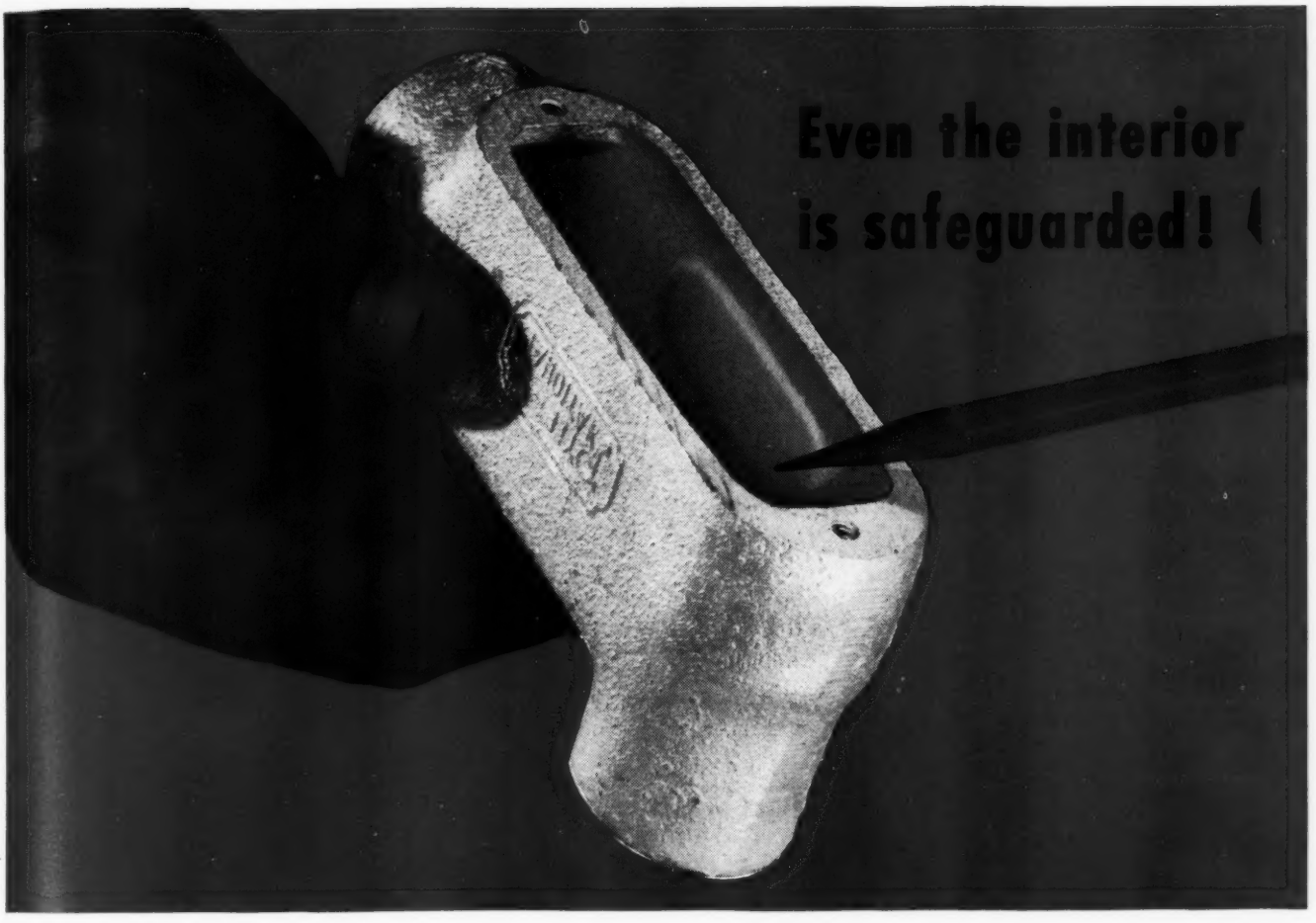
The HIG gyroscope, a measuring element developed by Minneapolis-Honeywell in collaboration with M.I.T. for the Air Force, was used recently to record the vibration of the 102-story Empire State Building, the Sub-Treasury Building, a 2-story office building, and the New York Public Library, for engineers and scientists attending the national convention of the Institute of Radio Engineers, in New York City.

M-H engineers installed the gyro in a central spot

MORE HEADROOM—FRAMEWORK SUSPENDS THE ROOF.



MORE HEADROOM—DESIGNED WITH TAPERED BEAMS.



PYLETS are completely, permanently protected with CADMIUM PLATING—CHROMATE-SEALED!

Rust and corrosion *never* get a chance at Pylet Conduit Fittings! A thick, heavy, all-over coat of cadmium plating . . . sealed in with a protective coat of chromate finish . . . makes Pylets stubbornly resistant to moisture, dust, or corrosive atmospheres. *No other* fitting provides this overall protection!

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provides hard-to-mar, lasting protection!

CHROMATE-SEALED
to preserve high luster and give extra protection against corrosion!

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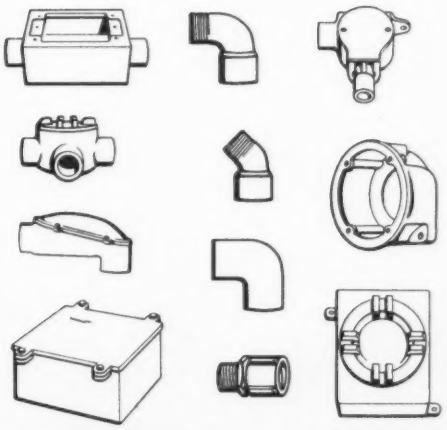

PYLETS are available in a complete line including circuit control Pylets, plugs and receptacles for all environments, industrial lighting fixtures, and floodlights. Ferrous alloy parts are cadmium plated and chromate sealed. Pylet literature furnished on request.

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Carrier again makes news

▼ *Carrier's New Room Weathermaker*

New Carrier Weathermaker ▲

▲ *Carrier's New Unit Weathermaker*
New Carrier Modular Weathermaster Room Unit ▼

Here are the newest ways to air condition an apartment building, a hospital, a hotel, a motel, an office building

The four Carrier units you see here have one thing in common—they're brand new!

They open up a good many interesting design and application possibilities in the jobs you're just starting.

They may even suggest compelling changes in plans you've virtually completed.

The New Carrier Weathermaker* (top left) is the one self-contained air conditioner designed for lower installation costs. It requires less space and permits more freedom in the location of the unit, singly or as part of a multiple unit system. Can be installed with or without ductwork, built in the wall, or located completely in the room.

Carrier's New Room Weathermaker (bottom left) is an extremely flexible fan-coil unit. It can be mounted horizontally or vertically, with or without cabinet. Put it on the ceiling or stand it on the floor anywhere in the room. Attach it to a wall. Fur it in. Or recess it under a window. Three sizes—½, 1, 1½ tons. For chilled or hot water, or direct expansion. Provides individual control of summer cooling or winter heating.

Carrier's New Unit Weathermaker (top right) is a fan-coil unit designed for overhead installation. It installs easily in the top of a closet, over a corridor or hallway, or behind a wall. Three sizes —½, ¾, 1 ton. For chilled or hot water, or direct expansion. Provides individual control of summer cooling or winter heating.

The New Carrier Modular Weathermaster* Units (bottom right) bring a new flexibility to the world's finest air conditioning—the Carrier Weathermaster System. The new under-the-window units with their modular components fit into a variety of combinations —decorative ledges, built-in cabinets and modern bookcases. Now it's easy to make air conditioning part of interior design.

Carrier has *all* ways to air condition *any* job—and all Carrier equipment is engineered to the same uniform standard. So shortcut hours of selection by (1) using the Carrier line as a shopping guide and then (2) comparing values. Get in touch with your Carrier dealer or branch office. They're listed in your Classified Telephone Directory. Carrier Corporation, Syracuse, New York.

*Reg. U. S. Pat. Off.

Carrier

air conditioning
refrigeration
industrial heating

on the 85th floor of the Empire State. Signals were telemetered to an electronic recorder located ten miles uptown in the Armory. The day's tests, conducted during a snowstorm and 30-50 mph winds, showed a natural vibration of 7 to 8 times per minute. In comparison, the other three buildings recorded vibrations of 50 times per minute and higher, in some instances above the capacity of the electronic recorder that charted the gyro's movement.

The HIG gyro (Hermetic Integrating Gyro), weighing less than three pounds, can detect motion 3000 times slower than the movement of the hands on a watch.

Although the tests were not set up to measure sway as such, there is a correlation between displacement and rate of motion. Under the storm conditions during the tests, the Empire State Building moved only one inch—a half inch off-center in each direction.

Milwaukee Studies Sewer Program Recommendations

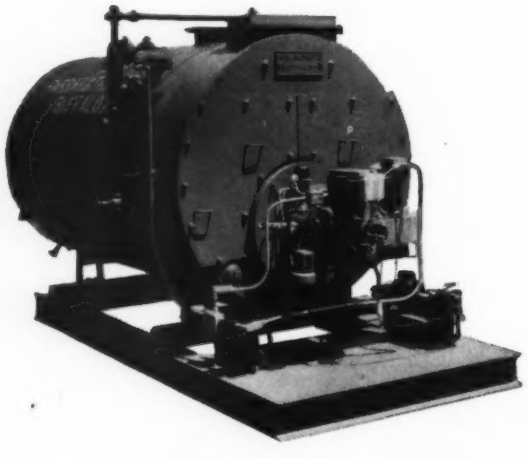
Recommendations for construction of a new sewage disposal plant along the lake front between South Milwaukee and Carrollville, and about 35 miles of large interceptor sewers at an estimated cost of nearly $44,000,000 have been submitted to Milwaukee city and metropolitan sewerage commission officials by Alvord, Burdick & Howson, after nearly five years of study. According to the report, adoption of the recommendations could practically eliminate bypassing of raw sewage into lake Michigan.

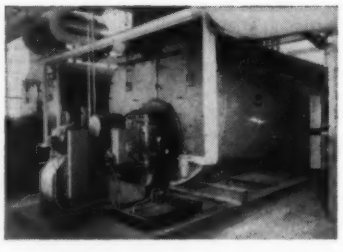
The study also pointed out that an estimated additional 15 miles of interceptor sewers could be built to serve the southern end of Milwaukee County, not now in the sewerage district, for another $7.5 million. And if the eastern part of Wakesha County, now drained by the Root River, were included in the area to be served by the new plant, the additional cost would be an estimated $1.4 million.

A reservoir with a capacity of one million gallons was recommended for the Jones Island disposal plant into which would be poured raw sewage that could not be handled during peak periods of flow. The reservoir would serve as a means of settling out much of the solids that now enter other sections of the plant and reduce its capacity.

Since cost of separating the combined sanitary sewers in the older parts of Milwaukee would cost the city an estimated $127 million, private property owners another $70 million to connect to the storm sewers, and interfere with business and industry, the consultants felt that this part of the over-all scheme should be put off to a later date. They suggested instead that separation should be accomplished whenever major overhaul of the system is necessary.

In areas of the city where basements are flooded during heavy rainfall, plans call for improvement of





Two BISON Super Scot Low-Pressure Boilers at Sylvania Electric Products, Inc., Batavia, N. Y. Engineers and General Contractors, Siegfried Construction Co., Inc., Buffalo, N. Y.; Heating Contractors, Joseph Davis, Inc., Buffalo, N. Y.

BISON

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Per unit of heating surface, Super Scot Boilers are bigger. They have a larger furnace, more steam space and water content. The area directly exposed to the radiant heat of combustion is a greater percentage of the total heating surface. Certified ratings are moderate but extra loads can be handled with larger burners.

Results—smokeless combustion, extra capacity for peak loads, lower maintenance, longer life and less cost of steam generated.

Consult F & T also for high-pressure boilers.

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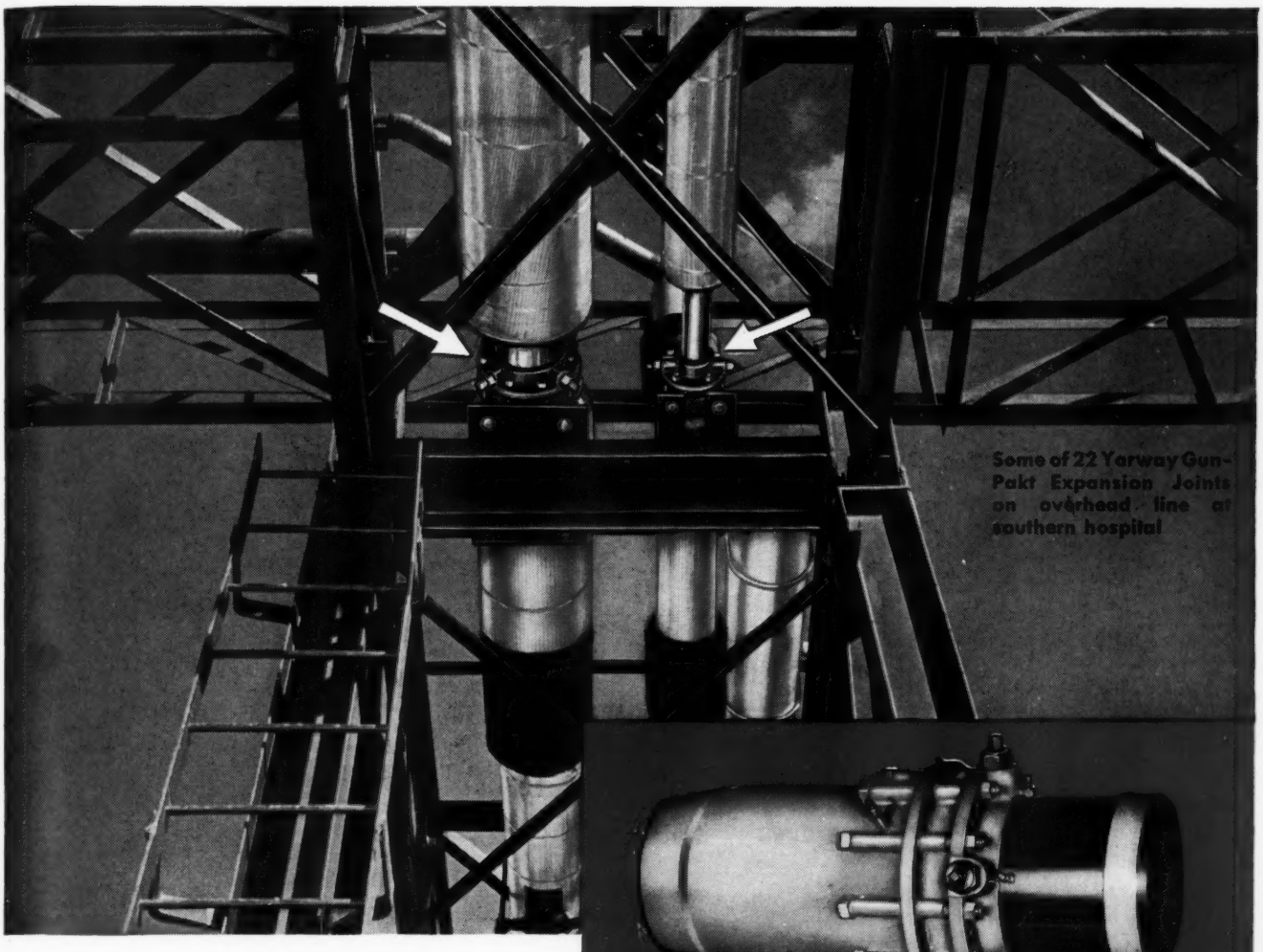
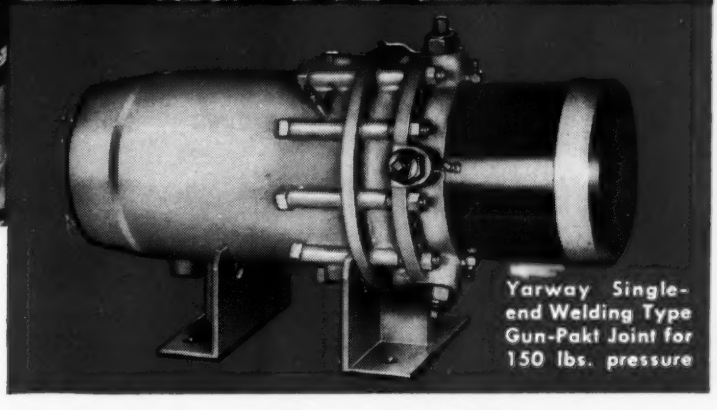


Some of 22 Yarway Gun-Pakt Expansion Joints on overhead line at southern hospital



Yarway Single-end Welding Type Gun-Pakt Joint for 150 lbs. pressure

HOSPITAL FINDS GUN-PAKT *SURE CURE FOR EXPANSION JOINT TROUBLES*

YARWAY Gun-Pakt Expansion Joints are just what the "doctor" ordered for this overhead steam line at a large southern hospital—and he ordered 22 of them!

In institutions, industrial plants and other large steam distributor systems YARWAY Gun-Pakt Joints are growing in popularity.

YARWAY Gun-Pakt slip-type joints give long life—no fatigue failures.

You need *fewer joints per length of line*, with traverses up to 12″ single and 24″ double.

With Gun-Pakt joints packing may be added as necessary, *under full steam pressure right on the job—no unpacking, no shutdowns.*

There's also *lower pressure load on end anchors* because excessive strains are eliminated.

All these are reasons why it will pay you to "do as the doctor ordered"—look into YARWAY Gun-Pakt Expansion Joints. Write for Bulletin EJ-1914.

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YARWAY

GUN-PAKT EXPANSION JOINTS

present sewers and better surface drainage, especially into the rivers and other streams.

The engineers recommended that construction of the new sewer plant and some of the interceptor sewers be built between 1957 and 1965 at a cost of $35.3 million. All facilities would then be completed by the year 2000.

Wrigley Field Fans Ride to Seats

Eight passenger conveyor belts are now in operation at Wrigley Field, in Chicago, carrying spectators from ground level to grandstand and upper deck locations. The belts operate in two sections of four units each. The lower four belts, each 5½ ft wide, have a rated capacity of 10,800 passengers per hour. The upper level system is equipped with 3⅓ ft wide belts, with a capacity of 7200 per hour.

Four centrally located control boxes operate the conveyors in four groups of two units each. The belts are reversible so that fans can be carried both to and from their seating sections. Passengers are moved uphill a total vertical distance of 60 ft.

Known as the SPEEDWALK passenger conveyor, the system is manufactured by Stephens-Adamson Mfg. Co. Similar conveyors were installed for the Hudson and Manhattan Railroad, at Jersey City, N. J., in 1954, and at the GM Powerama, in Chicago.

Plans for Super Highway Completed

Plans for the new $28 million Little Rock-North Little Rock, Ark., super highway have been completed by Brown and Blauvelt, New York consulting engineers, and are now under study by the State Highway Commission. Designed for 60 mph speeds, the expressway will free city streets of through traffic from five Federal and State Routes, as well as speeding local rush-hour traffic.

The highway will consist of six express lanes (three in either direction) separated by a 24 ft-wide median strip and flanked on both sides by 32 ft-wide service roads. Grade separations will carry through

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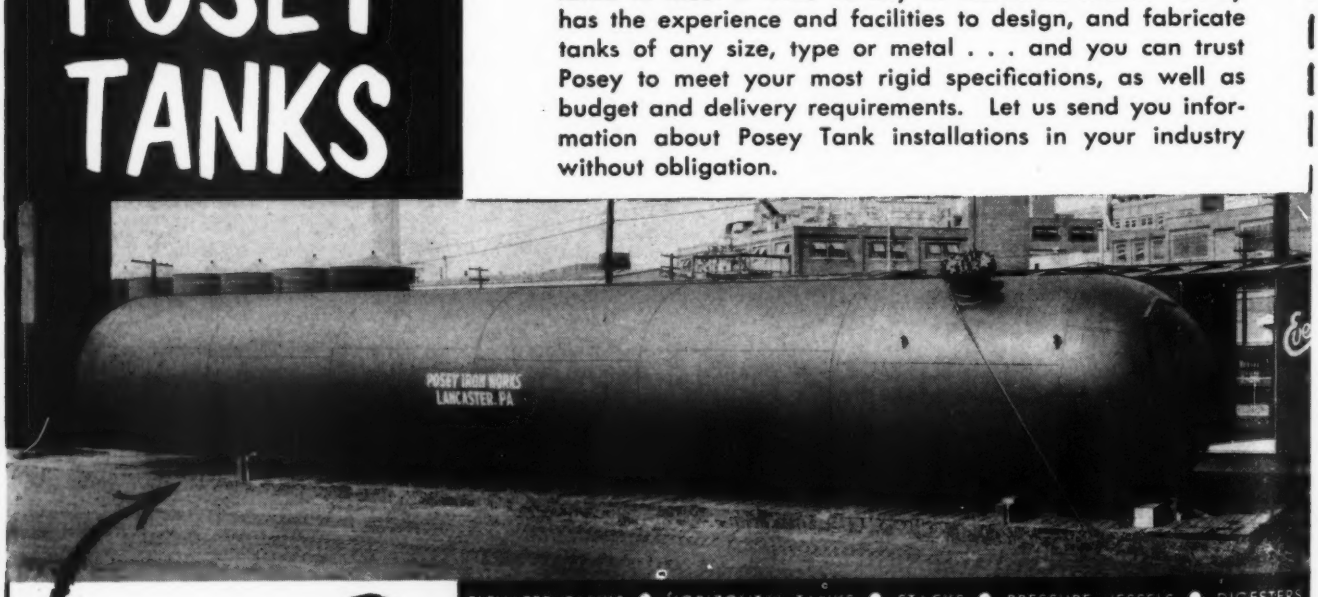

PROPANE STORAGE TANK
Length - 64' Diameter - 9'
Shell - 1" thick
Heads - ½" thick
Capacity - 30,000 gallons liquid

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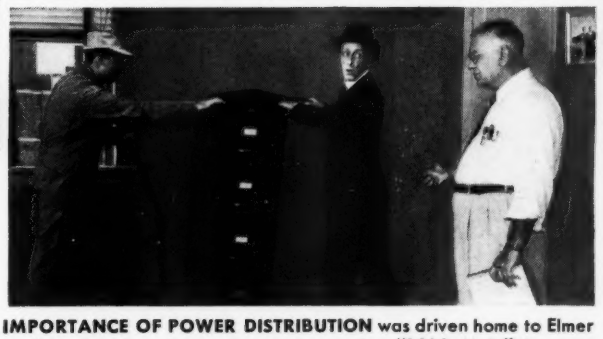
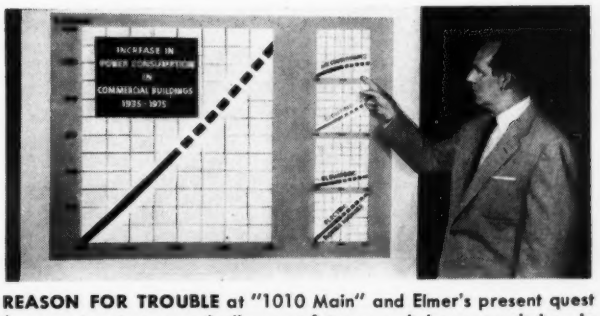
POSEY IRON WORKS, INC.
STEEL PLATE DIVISION • LANCASTER, PENNA.
NEW YORK OFFICE: GRAYBAR BUILDING

CLIMAX OF MOVIE, "The Tenant at 1010 Main," occurs as Elmer Payne (center) learns 480-v system could cut cost yet provide adequate power in his firm's new building.



IMPORTANCE OF POWER DISTRIBUTION was driven home to Elmer earlier when he witnessed tenant vacating "1010 Main" because building's system couldn't serve modern office machines and needs.



REASON FOR TROUBLE at "1010 Main" and Elmer's present quest for a system to economically meet future needs becomes obvious in view of load growth in last 20 years and that expected by 1975.

NEW General Electric film shows . . .

How to plan "up-to-the-future" power distribution for commercial buildings

"The Tenant at 1010 Main," latest motion picture in G.E.'s non-commercial More Power to America series, has just been released and is now available to you. This film portrays the importance of adequate power distribution systems in today's commercial buildings. It dramatically illustrates the consequences of outdated systems. And most important, it shows how to plan a system capable of accommodating future load growth as well as serving present demands.

CONSULTING ENGINEERS, CONTRACTORS, ARCHITECTS, BUILDING OWNERS can all use this entertaining, informative film which puts across the benefits of adequate power distribution in general, and modern, higher-voltage systems in particular. Though full of factual, engineering information, the film was especially designed to be acceptable to either technical or non-technical audiences. An authoritative manual, companion of the film, completes this MPA program.

More Power to America was launched in 1945 by General Electric to help America achieve higher productivity and better living standards through efficient application of electric power.

TO OBTAIN THIS FILM, or other MPA programs, contact your utility or nearest G-E Apparatus Sales Office, or mail coupon. MPA programs may be purchased or borrowed. General Electric Co., Schenectady, N. Y.

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streets across the expressway to permit free movement of city traffic and to provide adequate access to the road itself. Of the seven interchanges, two will be located at expressway terminals and five within the cities proper.

Main structure of the Arkansas River Bridge, part of the five mile long highway, will be 1570 ft with viaduct approaches bringing the total to 2040 ft. Main river spans will consist of two continuous girders with transverse floor beams and longitudinal stringers supporting the decks. Supports will be concrete piers resting on rock.

At normal construction pace, the expressway and bridge will take about four years to complete, according to the engineers.

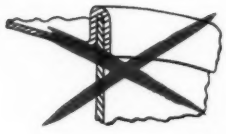
Architects and Engineers Join Forces to Push Amendment

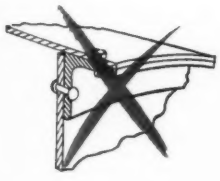
At the present time it is unconstitutional for outside architects or consulting engineers to be engaged to do structural work for the State of California. However, a Senate Interim Committee on Public Works appointed by the 1955 Legislature to make studies of the Department of Public Works, particularly the Division of Architecture, has submitted a constitutional amendment that would enable the State to employ engineers or architects on a contractural basis. This will be brought before the voters in the fall elections.

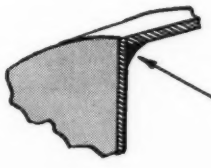
The architects and engineers of California have joined forces to work for the passage of this amendment, having formed a Joint Architects-Engineers Steering Committee whose primary purpose is to raise sufficient funds to put on a vigorous campaign. An estimated $150-175,000 will be required for the campaign—to be raised from the architectural and

BUT HENRY SAYS IT'S NOT "SELF-LAUDATORY" . . .

Bayley FAN-A-GRAFICS
For Equipment Engineers

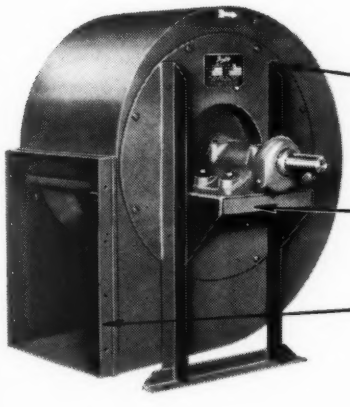




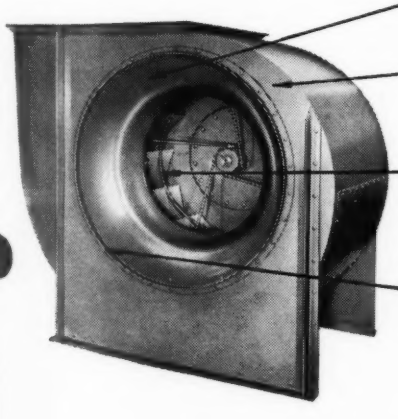


Craftsmanship

Presented here for your information are some basic facts revealing how superior quality Fans are built by a manufacturer credited with a long history of fine craftsmanship in production.



FEATURE	FUNCTION	BAYLEY Standards
Strong, light, continuous inside-welded housing seams, with smooth, neat exterior.	To avoid leaks, springing, warping, crinkling, vibration. Easily painted or insulated for seamless, trouble-free protection.	All types and sizes of fabricated steel housings.
Reversible Housing	Quickly available for any discharge position, permits field changes, simplifies or eliminates detailed preliminary layouts.	Type F and AP Fans to size 365 inclusive. Other styles to maximum practical.
Fabricated Brackets	Durability, maximum strength-weight ratio, matched to specific load requirements.	All types and sizes except very small fans.
Reinforced, system-ready outlet piece.	Quickly-made, tight connections. No "field manufacturing" required.	All types and sizes.

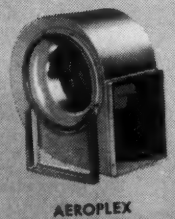


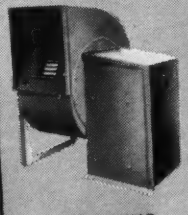
Smooth-spun, closely fitted Housing and Wheel Inlets.	Minimize turbulence and recirculation losses, provide maximum *realized* efficiency.	All AP Fans.
Ample Housing Side and Scroll Gauges (Made practical and effective by seam-welding.)	Uniformly high strength, stiffness, and corrosion resistance minimizes "breathing", vibration, perforation.	All types and sizes.
Accurately Prepared and Applied Wheel Blade and Shroud Reinforcement.	Maximum strength with minimum shaft load reduces moment of inertia, facilitates precision balance, minimizes vibration.	Type F and AP Wheels, according to size and speed.
System-ready Inlet Ring of ample length and stiffness.	Facilitates quick connection to inlet duct or accessory, originally or at a *later time*. System can be altered or extended without reconstructing or modifying fan.	All types and sizes. (Need not be explicitly specified.)

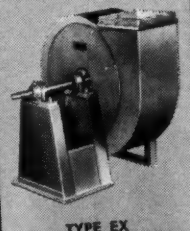
You'll find all these as well as many other quality features in BAYLEY Fans.
Send for Complete Line Bulletin CL-551.

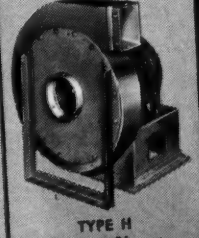
Our 100th Anniversary of Craftsmanship

PLEXIFORM
Forward Curve


AEROPLEX
Backward Curve


VENTILATING SET


TYPE EX
Industrial Fan


TYPE H
Pressure Blower

Engineered
AIR HANDLING EQUIPMENT

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- Self-adjusting for wear vane construction
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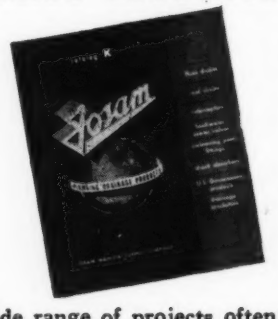

Engineers engaged in a wide range of projects often find the selection of plumbing drainage products confusing, time-consuming and costly. Your specification job will be quicker and easier if you use the Josam Catalog "K" as your reference. Illustrated and described are thousands of different drainage products designed to work better, last longer and install easier. Write for your free copy today!

THE JOSAM LINE INCLUDES:
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Dept. C.E.
Michigan City, Indiana

engineering professions and the construction industry at large.

The Joint Committee has recommended to its four member organizations—California Council of Architects, Consulting Engineers Association of California, Civil Engineers and Land Surveyors, and State Structural Engineers—the underwriting of the fee of $15,000 to retain the services of Latta and Company, public relations consultants, to conduct the campaign.

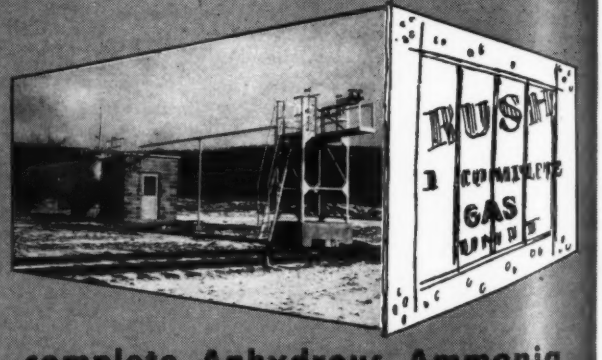
Drafting Equipment Available on Installment Plan

The Charles Bruning Company, Inc., manufacturer of Copyflex reproduction machines and materials and of engineering and drafting equipment, has announced adoption of a sales finance program through which Bruning equipment will be available under long-term installment plans.

The program, developed by C.I.T. Corp., provides terms to three years on an equal-monthly-payments basis, or terms to seven years with graduated payments geared to the sum-of-the-digits method of depreciation.

The equipment available under this plan will include Bruning Copyflex machines—used in both office and engineering operations to make black-on-white copies of practically any printed, written, typed, or drawn material—drafting room furniture,

YEARS of experience in 1 package



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drafting machines, surveying, and optical tooling instruments.

Down payments required on the installment sales plan will be flexible, but a minimum of 20 percent will be required on terms of more than five years.

New Consulting Firm Specializes in Computer Applications

Many sizes and types of electronic computing equipment are now on the market. To assist industry to make proper use of this equipment. Computing Consultants, Inc., Atlanta, Ga., has been organized to provide services in all phases of electronic computing and data processing—from application studies to programming, actual computing, and data processing for companies not possessing computers.

For companies with large amounts of paperwork or extensive calculations, Computing Consultants conduct studies to determine technical and economic feasibility of proposed computer application. Businesses with similar computational problems are encouraged to cut the cost of analyzing, programming, and coding the problem by making use of the CC service on a pooled basis.

Other services are: counseling on selection of the proper size, type, and make of computer; preparation of problems; and training of personnel to operate the computer. For firms with too little computer work to justify the cost of a machine, the group will handle the entire job. A. B. Simms is president of the new firm.

New Brewery Has Sandwich Wall

An aluminum and cellular glass "sandwich wall," only 3½ inches thick, is being used on the new bottling plant of the Duquesne Brewing Company, now nearing completion in Pittsburgh, Pa. The building, designed by the engineering firm of Peth and Reed, Pittsburgh, will eventually house all the brewery's bottling operations including shipping facilities.

The wall is constructed on the site. The backup sheet of aluminum ribbed industrial siding is set in place against supporting members and holes drilled through the valley of the ribbed sheet and the steel support. Drive screws are driven to hold the backup sheet in place. FOAMGLAS blocks, 1½" thick are then placed against the backup strip and temporarily secured with an adhesive.

The facing sheet is set in place over the insulation and holes drilled completely through it, the insulation, the backup sheet, and steel supporting members. The holes are spaced 8 in. on centers.

Finally, the complete panel is secured with stainless steel self-tapping screws which have neoprene and aluminum washers integral with the screw.

The choice of insulation for the "core" of the sandwich wall was of extreme importance. Since the building is to house a bottling operation, there will be considerable moisture in the atmosphere. The ribs of the aluminum serve as miniature "chimneys" to carry off any condensation. An insulation impervious to moisture was needed since the vapor flow would be across its surface. ▲▲

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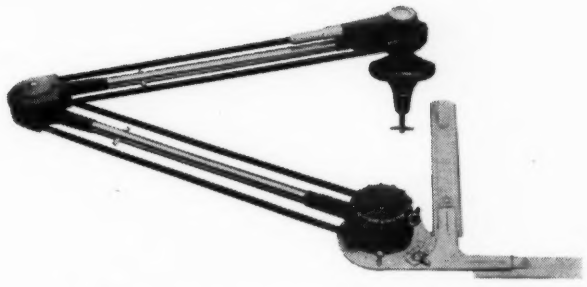
VEMCO FOR QUALITY DRAFTING EQUIPMENT



In the VEMCO Drafting Machine, the working features of a T-square, a protractor, various scales and triangles are combined into a single unit, ready for immediate use and leaving the drawing surface clear for convenient working. Its careful design, precise construction, and ease of operation meet the most demanding professional requirements.

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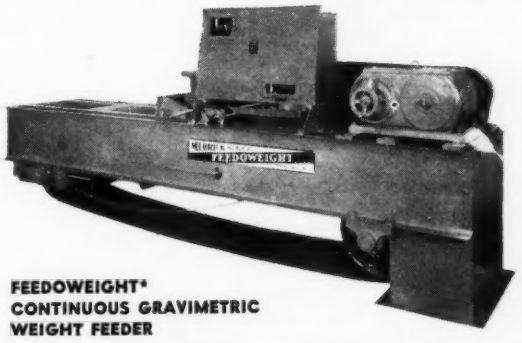

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Extensively used for ball and rod mill feeding. Widely accepted as the proper medium to accurately blend basic cement components such as clinker, gypsum, etc. Ruggedly constructed for long-life, trouble-free operation.

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Inefficient storage and handling of bulk materials runs costs up and production down. Let Marietta help you turn this cost factor into a profitable operation with a storage and handling installation engineered to the job.

Adaptable Marietta concrete silos will handle storage of any material from lump coal to core sand, chemicals, fly ash and etc. Their pre-cast solid or Air Cell concrete stave construction is sturdy . . . durable . . . fireproof. Moisture-resistant interiors eliminate costly waste or spoilage. Marietta storage silos are built with an extra strength factor for mounting any type of intake, discharge or materials handling equipment.

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DON'T FIGHT SHORTAGES
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Write for informative booklet on how Marietta plans, engineers and erects modern storage-handling systems for industry.

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Report From Germany

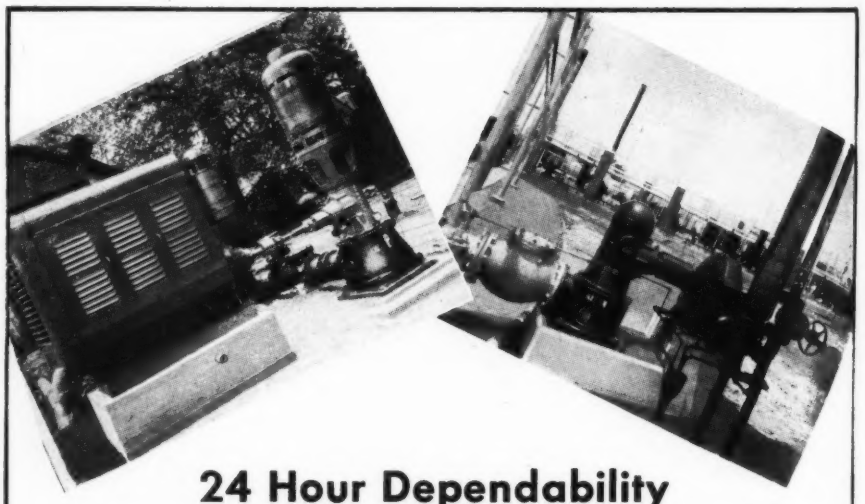
FRITZ HIRSCHFELD
Exclusive to Consulting Engineer

IN WESTERN GERMANY today there are about 1500 consulting engineering firms. Of this total, 750 are registered in a consulting engineer's Association called the VBI (Verein beratender Ingenieure) which is also a member of the International Federation of Consulting Engineers. The largest firms have approximately 60 employees; the average firms have about 20 coworkers. The VBI receives approximately 100 new members each year and loses roughly 20 members (through death) in the same period.

Membership rules for the VBI are very rigid. The main qualifying requirements state that a member must be a graduate of a recognized engineering school; have at least six years actual experience in his professional field and an additional year with a consulting engineering firm; be completely independent in his consulting work — not employee or representative of any other firm or agency. If there is any doubt as to his ability, he may be asked to take and pass a qualifying examination.

Membership in the VBI, among other privileges, allows the consulting engineer the right to use the VBI seal to identify his work. It is a seal of recognized professional standing and has been copyrighted since 1928. The consulting engineers outside of the VBI who do not have specialized standing and who have failed to qualify for VBI membership find increasing difficulty in obtaining contracts.

Under German law, a consulting engineer assumes unlimited civil and criminal liability for any damages that may occur as a result of proven negligence, poor design, or incompetence in completing a consulting assignment for a client. Strict laws and their forceful interpretations have caused German consulting engineers to set high standards on the professional qualifications of their



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Combination and Dual	Solid Shaft

Illustrated Engineering Catalogs On Request

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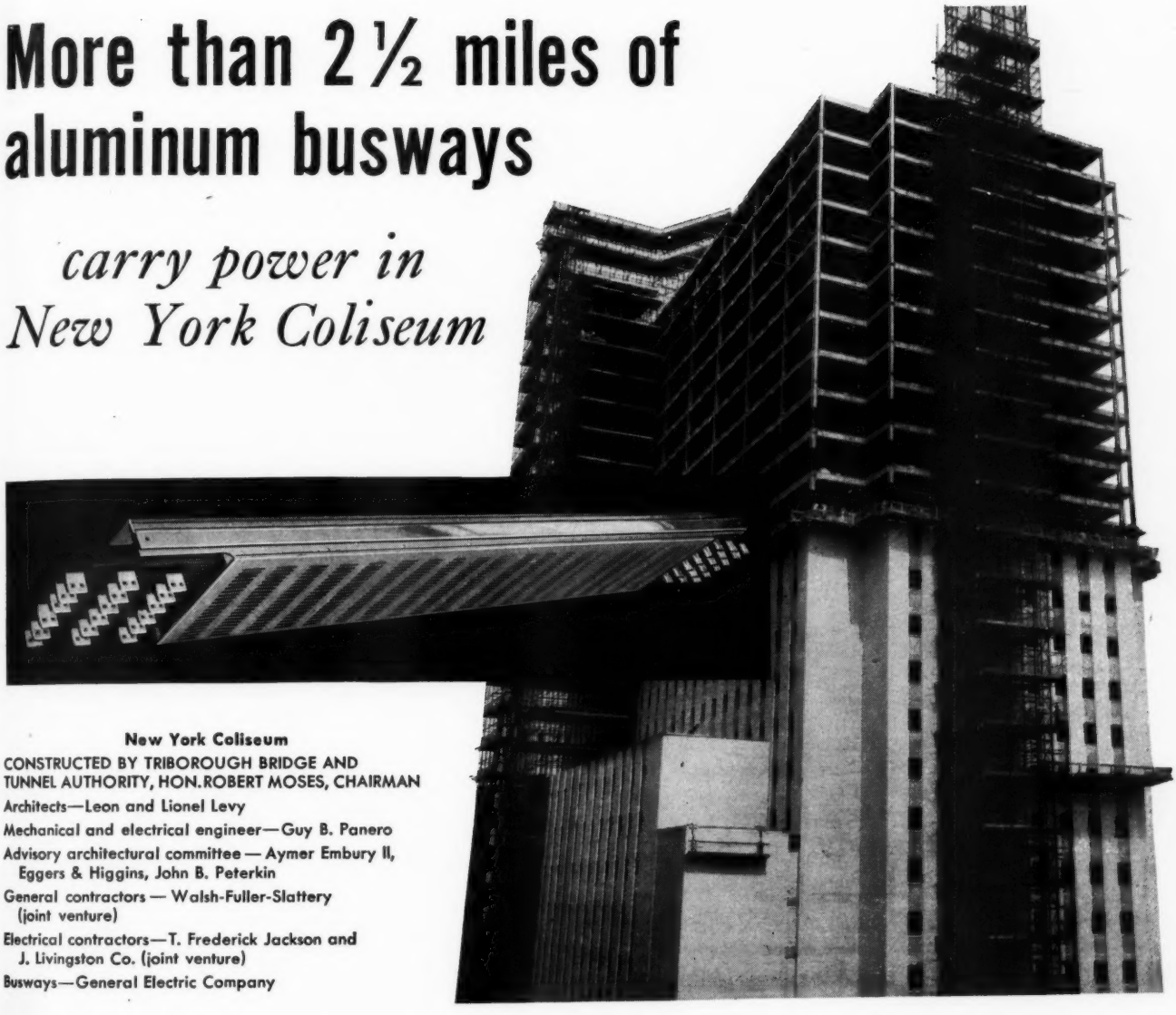
More than 2½ miles of aluminum busways

carry power in New York Coliseum



New York Coliseum
CONSTRUCTED BY TRIBOROUGH BRIDGE AND TUNNEL AUTHORITY, HON. ROBERT MOSES, CHAIRMAN
Architects—Leon and Lionel Levy
Mechanical and electrical engineer—Guy B. Panero
Advisory architectural committee — Aymer Embury II, Eggers & Higgins, John B. Peterkin
General contractors — Walsh-Fuller-Slattery (joint venture)
Electrical contractors—T. Frederick Jackson and J. Livingston Co. (joint venture)
Busways—General Electric Company

Important Innovations in Coliseum

New York City's new Coliseum is modern in every detail, particularly in its electrical distribution system. This 26-story office building, combined with 365,000 square feet of display space, has one of the first major installations of a higher voltage distribution system (480Y/277 volts). More than 2½ miles of busway incorporating aluminum conductors were used to feed power to this huge structure.

Higher Voltage System Saves Money

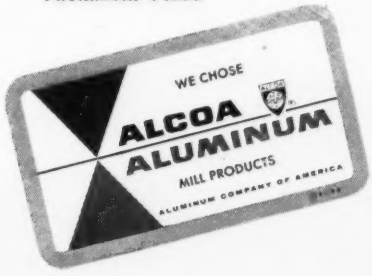
The higher voltage system provides greater capacity and flexibility than conventional systems. Yet it requires only half as many, or half as large, risers and feeders. Characteristics such as excessive voltage drop or costly power losses present no problems to this system. The use of lightweight aluminum bus bars makes the equipment easier to handle and easier to install.

More and more manufacturers of packaged electrical distribution systems are finding that Alcoa® Aluminum Bus Conductor offers advantages of lower cost, availability, design flexibility. Aluminum distribution bus weighs a third less than a copper system of equal conductivity. Pound for pound, it has greater current-carrying capacity than cable in conduit.

Alcoa Aluminum Is Your Best Bet, Too

Wherever your production requirements demand an efficient, flexible electrical distribution system, it will pay you to specify busways with Alcoa Aluminum Conductors. Write us for the names of manufacturers who specialize in this lighter, better, more economical product. Aluminum Company of America, 2311-E Alcoa Building, Pittsburgh 19, Pa.

Your Guide to the Best in Aluminum Value



THE ALCOA HOUR
TELEVISION'S FINEST LIVE DRAMA
ALTERNATE SUNDAY EVENINGS

New Socony Mobil building, New York City. Galbreath Corp., owner; Jaros, Baum & Bolles, Consulting Engineer; Kerby Saunders, Inc., Air Conditioning Contractor; Turner Construction Co., Builder.

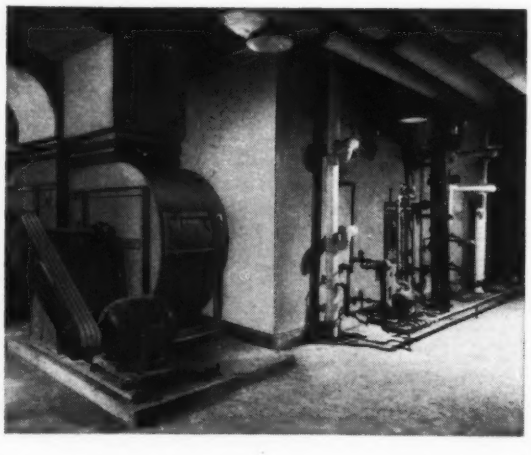
WORLD'S LARGEST AIR CONDITIONED COMMERCIAL OFFICE BUILDING USES 75 FANS, 22 CONDITIONING UNITS BY "BUFFALO"

A new landmark at Lexington and 42nd St., New York, the Socony Mobil building is a model for office buildings of the future. It is the largest fully air conditioned commercial office building in the world — the largest built in New York in a quarter-century. Offering so much to tenants, it is little wonder that its 1,300,000 square feet were virtually 100% rented before completion.

Selection of "Buffalo" for all the fans and many of the conditioning units reflects the confidence which engineers, owners and contractors have placed in "Buffalo" for the past 79 years. You will find "Buffalo" air handling equipment in outstanding plants, hotels, institutions, stores and public buildings throughout this hemisphere. And everywhere, you will find it performing to satisfaction, because "Buffalo" builds the "Q" Factor* of Quality into every unit. If you have a job for air, write "Buffalo" into the plans to insure the results you want.

"Buffalo" Type BL Fans handle air in Socony Mobil building. These fans (some of them 13 feet high) plus "Buffalo" Axial Flow Fans and "Buffalo" Shortboy Ventilation Units move all the air. PCLW Dehumidifiers, Humidifiers and PC Air Conditioning Cabinets process the air for various zones.

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*



"Buffalo"

BUFFALO FORGE COMPANY

BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING
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registered members. It has also stimulated German insurance firms to develop insurance policies that provide adequate coverage for the various risks to which the consulting engineer may be exposed.

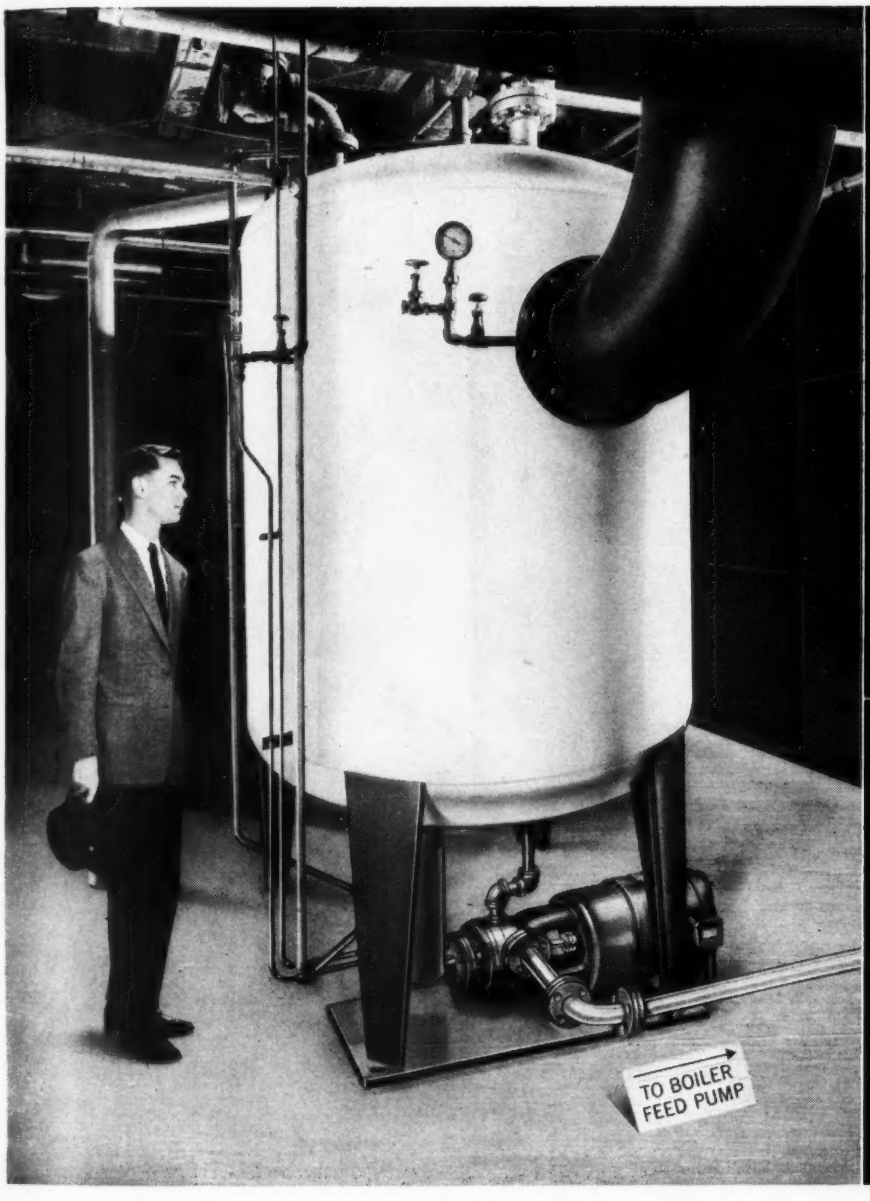
When a consulting engineer negotiates a contract, the client may demand that he carry liability insurance. But generally the consultant finds it to his own benefit as well as that of the client to protect himself against the hazards of unlimited liability. He may buy insurance protection to cover three separate liability circumstances.

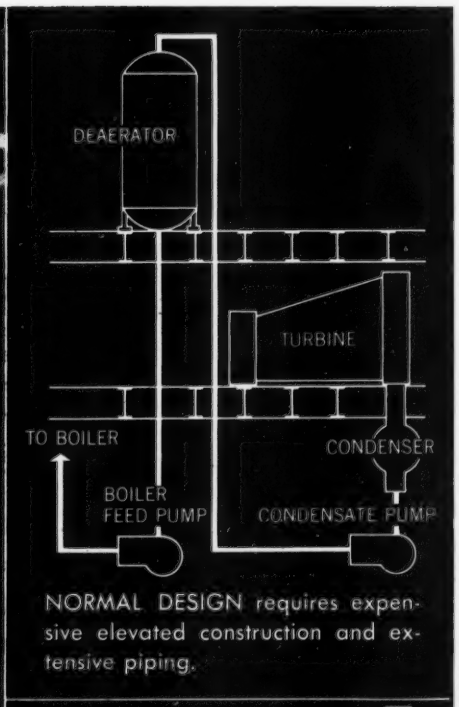
Suppose that the consulting engineer specializes in heating systems, and his assignment calls for the installation of a hot water radiant heating system in a commercial building. In his specifications the engineer may designate a tubing size with a wall thickness too thin for the operating pressure of the system. As a result, the tubing may rupture during operation and the water may loosen the plaster in the ceiling. A piece of plaster falls and causes injury to an occupant in the room below. The insurance liability coverage, in this case, will pay up to about $72,000 for each such accident.

Second, since an investigation would probably show that the broken tubing was the result of faulty design on the part of the consulting engineer, he is also liable for the subsequent property damage — the damaged ceiling. His liability insurance covers him to the extent of roughly $7,200 for each such property accident. (The terms of the contract with the client would undoubtedly call for the replacement of the faulty tubing at the expense of the consulting engineer and this item is not covered by insurance.)

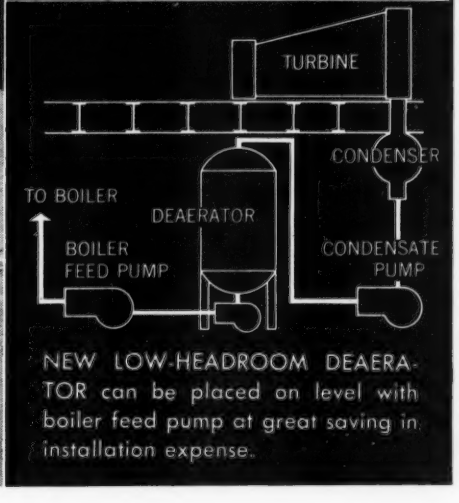
A third circumstance that the insurance will cover protects the client against the over-design of a project and the excessive use of material. For example, should the client's own engineers check the consulting engineer's calculations and find that he had specified a boiler capacity in excess of the heating requirements, the client can then sue to recover the amount of money that had been wasted in this excess installation. The insurance will cover each such incident of material liability up to about $4,800.

The insurance system is extensively used and seems to work to everyone's advantage. There are a number of private insurance companies in Germany that provide the three forms of liability coverage. The VBI does not favor any one insurance firm, and the engineer is his





NORMAL DESIGN requires expensive elevated construction and extensive piping.



NEW LOW-HEADROOM DEAERATOR can be placed on level with boiler feed pump at great saving in installation expense.

New low-headroom deaerator makes oxygen removal economical for the smaller plant

Now every plant, large or small, can cut steam plant maintenance . . . and do it economically . . . by using deaerators. A new "low-headroom" deaerator, just developed by Worthington, allows you to install the unit *inside* your power house. You don't have to pay for expensive elevated mounting and complicated piping!

To provide adequate water pressure, it used to be necessary to elevate the deaerator above the boiler feed pump intake. A small pump on the new "low-headroom" unit now furnishes this pressure without the need for elevation. Result: considerable saving on installation and piping.

A patented* recirculation system prevents vapor-binding and provides means for preheating and deaeration before start-up. It gives you maximum oxygen removal even under abnormal operating conditions.

Available in standard sizes up to 80,000 pounds per hour, and larger in "tailored" designs, the new "low-headroom" deaerator can be installed in your plant in a matter of weeks. For more information call your nearest Worthington District Office or write Section S63, Worthington Corporation, Steam Power Department, Harrison, N. J. In Canada: Worthington (Canada) 1955, Ltd., Toronto, Ont.

S.6.3

WORTHINGTON

*Patent No. 2308719-20 & 21 2564583 — other patents pending

United States Steel Corporation • Gary Sheet And Tin Mill
Continuous Annealing Line • Engineers: United Engineers & Constructors, Inc.

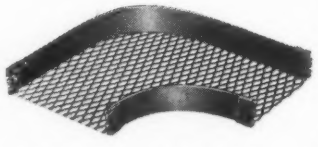
Lower Installed Cost For Industry With Cope Cable Trough

U. S. Steel adopted Cope Expanded Metal Cable Trough for power distribution. Cope Cable Trough *saves labor* during installation because Cope Cable Trough is faster to install—easier to design—than any other cable supporting system. Exclusive Pin-Type Coupler simplifies every connection.

Engineers everywhere are specifying Cope Expanded Metal Cable Trough because it:

Saves Materials • Saves Space • Simplifies Maintenance and Inspection
Permits Higher Cable Current Ratings **Improves Flexibility**

Specify the new Cope 70,000 Series with exclusive Pin-Type Coupler that greatly reduces installation time



Our engineers are ready to work with you. Write us today for full details on new 70,000 Series.

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Cope

TEE

DROP-OUT

CABLE SUPPORTING RISER ELBOW

TROUGH WITH BARRIER STRIPS AND COVER

own free agent in selecting the insurance company and the form and extent of his coverage. There is nothing compulsory about it.

It is reported that at the very highest the claims for any given period have never exceeded more than two-thirds of the premiums paid in during the same period of time — a fact that has helped keep premiums low and has also proven a profitable business risk for the insurance companies. Damages for personal injury claims seldom occur. Other claims for amounts over $2,500 are rare.

As an interesting sidelight, the client is further protected by the fact that the contractor generally carries similar liability insurance. Also, on projects where static calculations are critical — a bridge, dam, large building — a Government inspector, whose work is also protected by liability insurance, rechecks all these static calculations. This has reduced the margin of error to a minimum and practically eliminated engineering catastrophes.

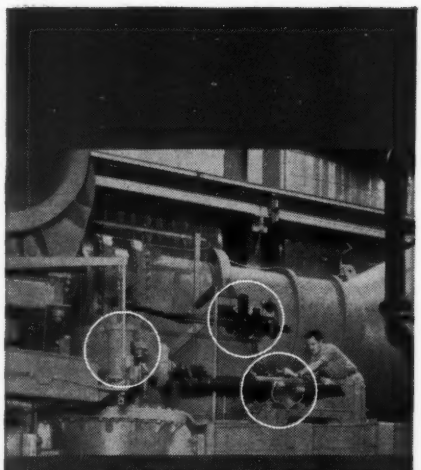
The system of insurance makes it possible for the client to readily determine where to place the responsibility in event of trouble. Even where four or five different consulting engineers work on a project as a team, each one has his fixed area of responsibility and carries his own insurance protection. Most claims can be settled quickly between the insurance representatives and the client, out of court, without long delays and expensive trials.

The insurance companies have a sound experience base for setting premium rates, and the premiums are considered to be fair and within reason.

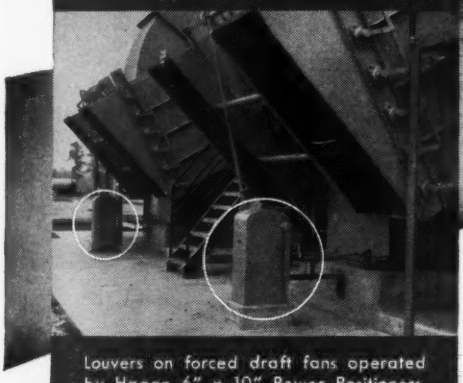
Insurance companies are very careful whom they insure. That is why membership in the VBI carries a great deal of weight in obtaining coverage at a reasonable premium. If a consulting engineer member of the VBI starts to have too many accidents, his professional qualifications may be reviewed, and in serious cases he may be asked to resign.

Unfortunately, no method has yet been determined for writing insurance to cover foreign consulting projects. This is one of the problems the VBI hopes to tackle in the very near future.

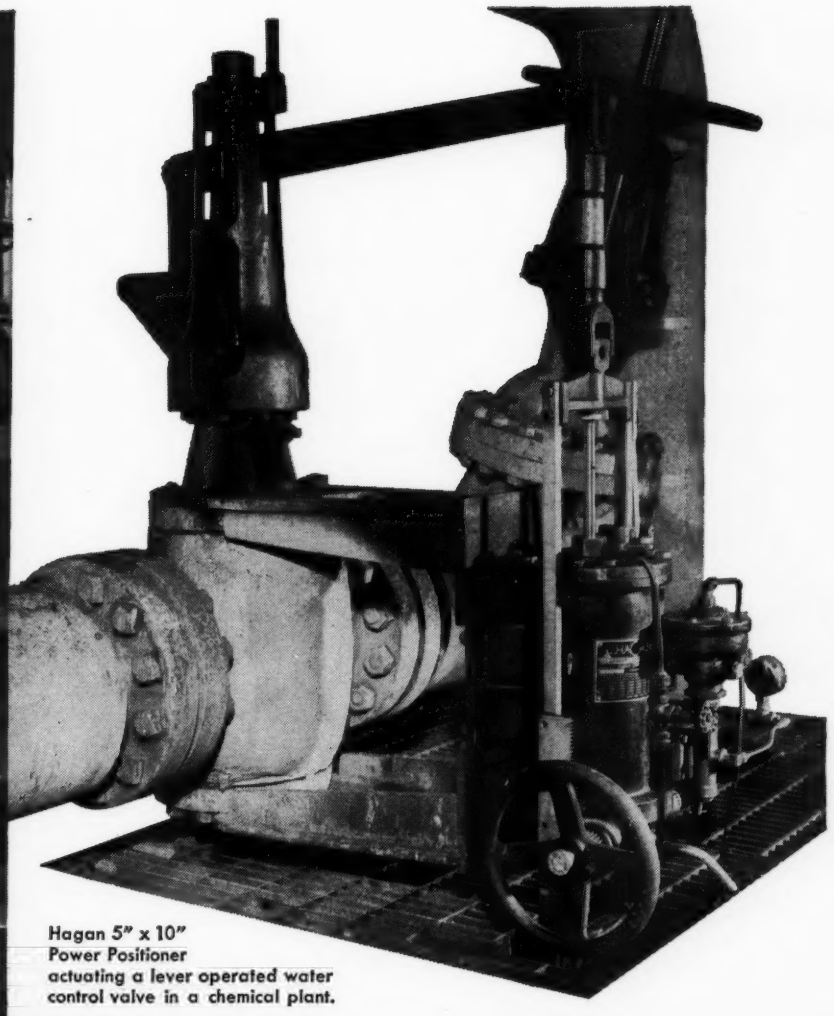
In Sweden and Switzerland, where the liability of the consulting engineer is restricted to the maximum amount of his fee, there is a good deal of interest in the German system of liability insurance coverage. The Swedes, especially, are considering the adoption of a similar method of liability protection.



Two 8" x 20" and one 5" x 20" Hagan Power Positioners operating plug valves on a wind tunnel in an aeronautical test facility.



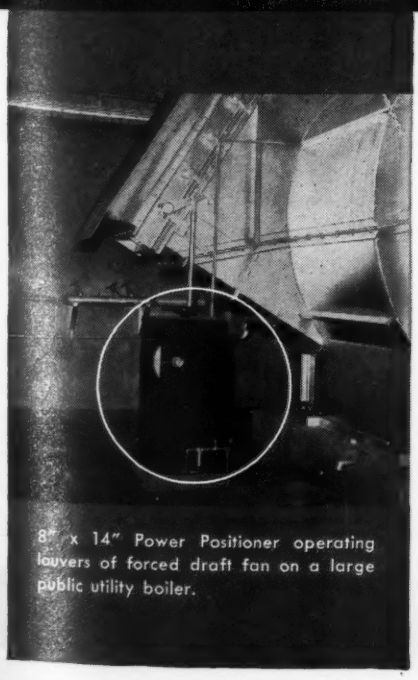
Louvers on forced draft fans operated by Hagan 6" x 10" Power Positioners. Note outdoor installation.



Hagan 5" x 10" Power Positioner actuating a lever operated water control valve in a chemical plant.

HAGAN POWER POSITIONERS

HIGH PRECISION—LOW MAINTENANCE!



8" x 14" Power Positioner operating louvers of forced draft fan on a large public utility boiler.

Hagan Power Positioners provide the "muscles" for thousands of control applications in every type of industry—wherever torque and positioning accuracy requirements are severe.

Hagan Power Positioners are economical, both in first cost and in the low maintenance costs which result from their uncomplicated design and strong construction. Many Hagan units are still giving trouble-free, dependable service after years of exposure to rigorous conditions, such as high ambient temperature (up to 160°), corrosive atmospheres, or outdoor installations.

Hagan Power Positioners can help you lower costs in all your final power drive needs. Write for Specification File TP-MFI for information on the full range of these powerful "Muscles for Industry."

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HAGAN BUILDING, PITTSBURGH 30, PA.

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Systems and Components for: Boiler Combustion Control, Metallurgical Furnace Control, Process Control, Aeronautical Testing Facilities • Industrial Water Treatment • Chemicals for Water Conditioning

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★ VERSATILITY
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RIVETED "RETICULINE"

The most substantial grating design made for distribution of heavy loads and rugged needs. Provides maximum traction combined with smoothness for walking, working, wheeling in all directions.

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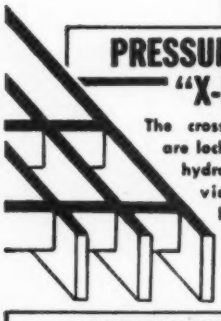
Special cross bar effects smoothest, most efficient one-piece welded construction, assuring maximum strength with minimum weight, and safety underfoot.



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The cross and bearing bars are locked under tremendous hydraulic pressure to provide a strong, safe, lightweight floor. X-Bar Grating is self-cleaning and most economical.

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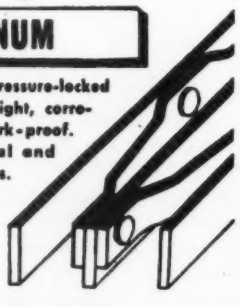
In riveted and pressure-locked types only. Extra-light, corrosion-resistant, spark-proof. Ideal for chemical and petroleum industries.



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1856 10th St., Oakland 20, California

MEN IN ENGINEERING

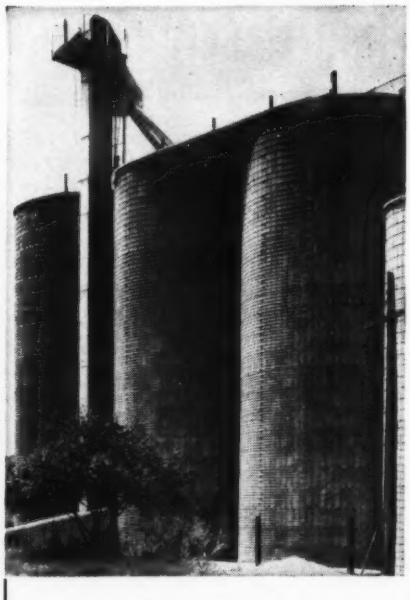
David B. Steinman, noted bridge engineer, has received two new decorations: honorary membership in the Academie Universelle, Paris and Diploma & Gold Medal of the Associazione di Cultura Letteraria e Scientifica, Genova.

Dr. Foster Dee Snell, president of Foster D. Snell, Inc., has been appointed representative of the United States on the water, sewage, and sanitary wastes division of the Applied Chemistry Section of the International Union of Pure and Applied Chemistry. The group is studying "The economic use of water and the solution of effluent problems in industry." Initial reports of the division will be available for discussion at the meeting of the International Union in Paris during the summer of 1957.

Raymond L. Geiger and Richard F. Wittenmyer have been appointed associate research directors of The Austin Co.

Dr. Herman W. Dorn, head of Dorn & Co., food and drug consultants, has been named to the board

Big Stocks of Glass Materials in 9 NEFF & FRY Bins



Barytes, cullet, feldspar, limestone, salt cake, silica sand, slag, soda ash—these are the materials handled and stored in Neff & Fry Bins at Foster-Forbes Glass Co., Marion, Ind. Four of the nine bins are shown in the photograph.

It would take this entire space to list all of the flowable bulk materials for which our bins are used. In many cases, considerable ingenuity is required to meet the loading and unloading situations. That's when our engineering knowledge plays an important part.

Chances are you'd select our bins for your bulk materials if you knew all the reasons. Ask for our folder, "Bins With the Strength of Pillars."

Not exported except to Canada and Mexico

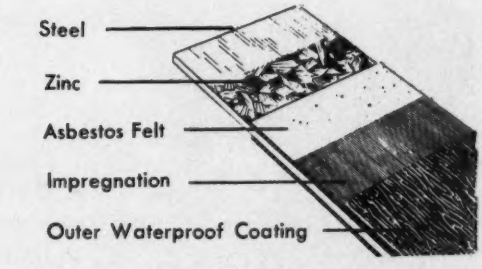
THE NEFF & FRY CO. • 302 Elm St. • Camden, Ohio

NEFF & FRY ▸ SUPER-CONCRETE STAVE STORAGE BINS

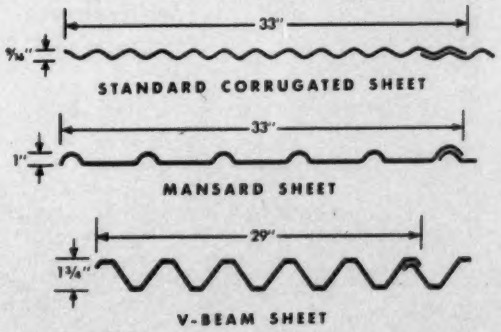
Low cost, maintenance-free beauty for your roofs and sidewalls . . .

After decades of research and more than seven years of exhaustive tests held under the auspices of its multiple fellowship at the famed Mellon Institute of Industrial Research, H. H. Robertson Company is proud to announce Galbestos roofing and siding in four attractive new colors—red, green, buff, gray. Galbestos in black or maroon has long been the standard of perfection among protected metal roofing and siding materials for its maintenance freedom, long-life resistance to fire and corrosion, and ability to withstand extreme weather conditions. Color Galbestos has proven itself equal or better in every respect.

With Color Galbestos you now can have colored roofs and sidewalls at a lower cost than that possible by any other means. These new colors and the three standard corrugations shown at the right, used singly or in combination, open a new field of decorative treatment for industrial and commercial structures. Use the coupon to write for literature.



The exclusive Galbestos method of protecting steel is responsible for its extreme durability. Color Galbestos can be furnished colored on one or both sides . . . in flat sheets or in corrugations shown below.



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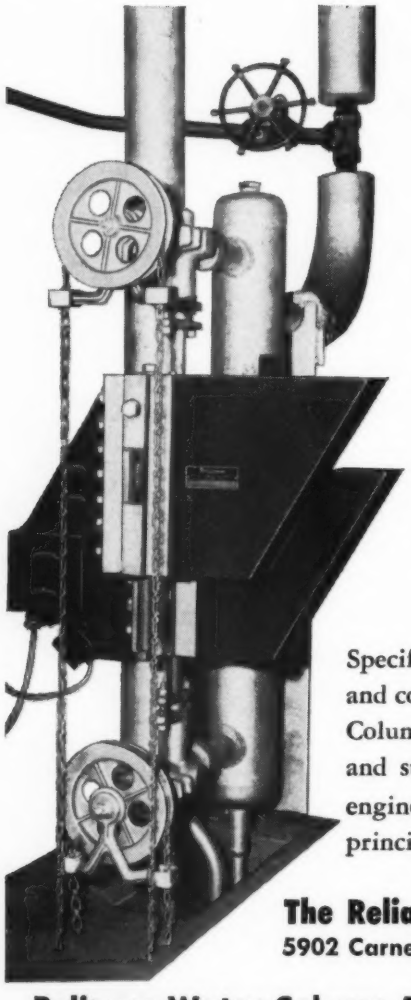
Gages and Safety Specialties

assure you the utmost in

Dependability



Since 1884, Reliance has maintained leadership in Boiler Safety Device development and manufacture. Water Columns with automatic Alarms, operated by the original *instantaneous* alarm mechanism, have helped to fortify power plants against the consequences of boiler water failure for billions of operating hours. Whistle alarms are available on columns for pressures to 900 psi; electric alarms, actuated by Reliance Electrode Levalarms, to 2500 psi.

For higher pressures — to 2500 psi — Reliance standard and custom-built equipment embodies principles of design and construction perfected in 70 years of *specializing* in this field—"super-rugged" Water Columns built with a generous margin of safety and tested at twice rated capacity.

Specified by many boiler manufacturers and consulting engineers, Reliance Water Columns exceed requirements of national and state code authorities . . . Reliance engineer representatives are located in all principal cities. Write for Bulletin 516.

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Water Gage Valves Gage (try) Cocks
Gage Inserts: Prismatic, Mica-protected Flat Glass, "Micasight"
Direct-to-Drum Water Gage Assemblies
Complete Line of Water Gage Illuminating Equipment
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Levalarms — Float-type Liquid Level Alarm Devices
Levalarms — Electrode-type Liquid Level Alarms, Fuel Cut-out and Pump Control

The name that introduced safety water columns....in 1884

Reliance®

BOILER SAFETY DEVICES

of directors of the Coreboard Products Corporation.

Jose B. Calva, president of J. B. Calva & Co., Minneapolis, has been elected president-elect of the Minnesota Society of Professional Engineers. Calva is also active in the Minnesota Association of Consulting Engineers.

Raymond Stevens is the new president of Arthur D. Little, Inc. He has been a vice president of the company since 1930.

Anderson-Nichols and Co. has appointed Octave W. Imer as chief structural engineer.

IMER FRASER

James R. Fraser has been appointed chief engineer of the H. K. Ferguson Co. John G. Thiel will succeed Fraser as district chief engineer in Cleveland.

Fred S. Dubin Associates announces the following promotions: Harold L. Mindell to partner, Peter S. Myers to associate engineer, George J. Giannoni to electrical department head, Sidney J. Greenleaf to project engineer.

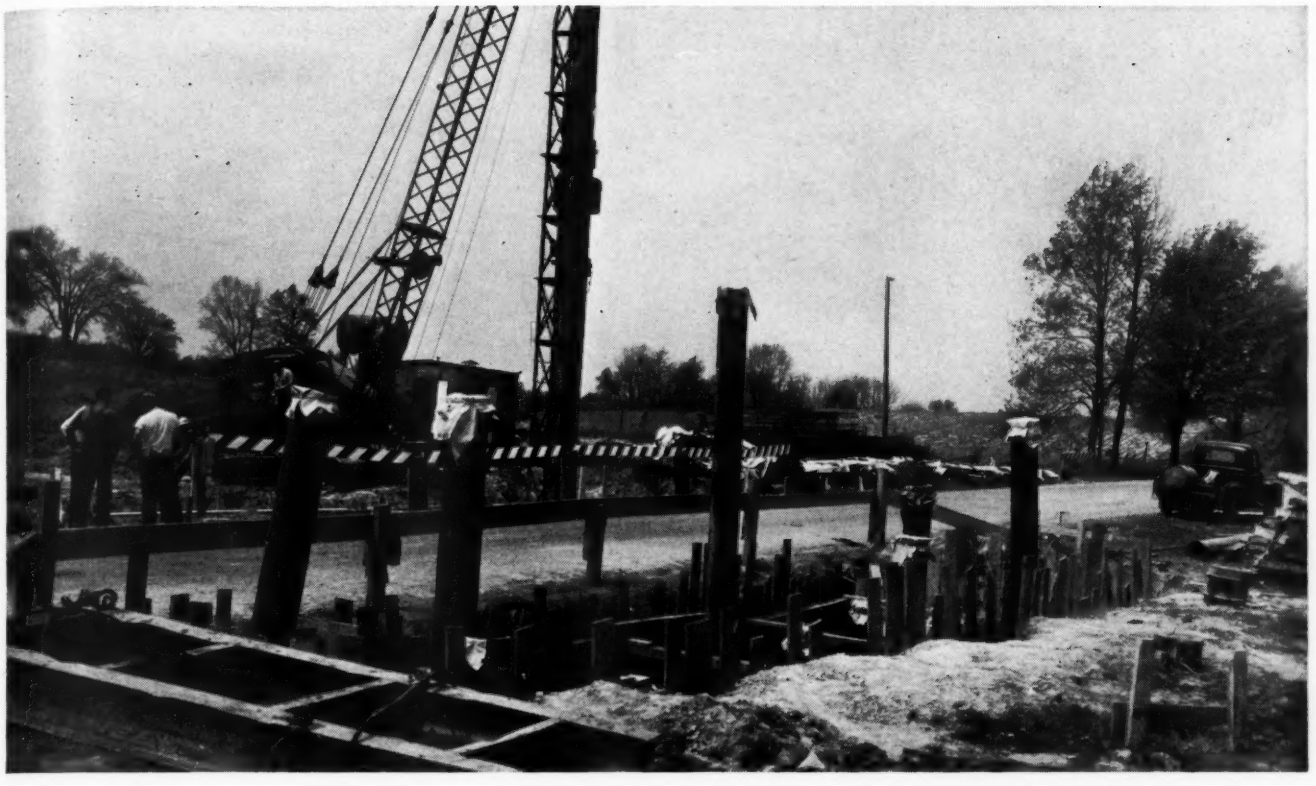
Two consulting engineers will be among the speakers and panelists at the 2nd annual Prestressed Concrete Institute convention, to be held May 16-18 at the Hollywood Beach Hotel, Hollywood, Fla. They are Ross Bryan, of Nashville, Tenn. and H. H. Edwards, of Lakeland Engineering Associates, Lakeland, Fla. Edwards is sec'y-treasurer of the Institute.

A new firm of consulting engineers, Consulting Engineers, Inc., has opened offices at 184 Boylston St., Boston, Mass. Joseph S. Pollinger is general manager.

Norman G. Kappler has joined the Lummus Company as pulp and paper industries consultant.

The H. K. Ferguson Co. has opened a new engineering office in Ft. Lauderdale, Fla. to handle its growing volume of industrial design work, particularly for new plants in the south. The office will have a staff of about 50 engineers, designers, and draftsmen.

Salvatore S. Guzzardi, consulting engineer of Philadelphia, has received a citation from *Power* for outstanding accomplishments in



Piling operations at Structure 53-5, Indiana Toll Road. Pile Diameter: 12", Wall Thickness: .172", Hammer: Vulcan No. 1

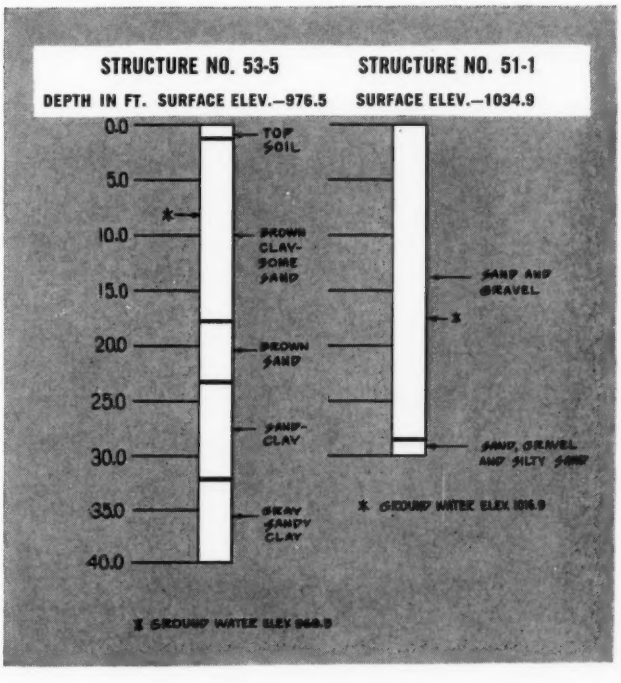
How Armco Pipe Piling Met Varying Foundation Requirements on the Indiana Toll Road

Soil Logs for Typical Grade Separation Structures Illustrate Different Driving Conditions

The soil logs reproduced here illustrate the widely varying conditions encountered at the site of two typical grade separation structures on the Indiana Toll Road. Under structure No. 51-1, hard driving sand and gravel; under structure No. 53-5, relatively easy driving clay.

In both cases Armco Pipe Piling provided the efficient answer. It withstood up to 100 blows per foot to reach the required minimum 20-foot penetration at structure 51-1. In the less stable soil at Structure 53-5, penetrations of more than 40 feet were needed to meet the same 30-ton bearing requirement. The constant cross section of Armco Piling made it easy to splice. Cut-offs could be salvaged. And high collapse resistance assured straight piles, easily inspected for watertightness.

Write us about your foundation problems. Your nearby Armco man will be glad to show you performance data on Armco Pipe Piling in a wide range of driving conditions. Armco Drainage & Metal Products, Inc., Welded Pipe Sales Division, 4756 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. In Canada: write Guelph, Ontario. Export: The Armco International Corporation.



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can this new Wet Scrubber solve a Dust, Fume or Odor problem... *for you?*

Type A
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Johnson-March Dust Control Specialists can help you with your Dust Collection or Material Recovery Problems

Dust ranging down to sub-micron sizes can be efficiently and economically collected. Johnson-March experts have a valuable background of information and experience in the field of dust control, and can put it to work for you and your clients.

Dust, fumes or odors can be both an annoying and costly nuisance. Why not let Johnson-March help you with *your* dust control problems. Write for Bulletin describing J-M Scrubbers.

Johnson March

Dust Control Engineers

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CANADIAN REPRESENTATIVES: G. F. Sterne and Sons, Ltd., Brantford, Ontario

modernizing power service facilities during 1955.

Ebasco Services, Inc. has announced three new appointments to its staff: Gordon A. Atwater as senior consultant in the Space Planning Department; and Dr. Henry C. Ott and Julius M. Simmons as nuclear engineers in the Nuclear Engineering Division.

Thomas W. Burtt has been appointed to the position of vice president in charge of engineering and construction at Holmes & Narver, Inc., Los Angeles. He is also a member of the board of directors.

Joseph E. Biro and Associates have moved to larger quarters at 500 Bushkill Drive, Easton, Pa.

Boyd L. Crandall and Archie N. Colby have joined the staff of Bruce Payne and Associates, Inc., of Westport, Conn., as senior associates. Crandall's field will be industrial engineering, manufacturing, and quality control. Colby will work on management organization and Operations Research.

William Boyd has opened a marketing consultant office to advise on sales and related problems for industry. Address is the Investment Building, Pittsburgh, Pa.

At Foster D. Snell, Inc., Gabriel Appleman has been appointed assistant director of engineering; Joseph W. La Cerra has joined the staff as project engineer.

FOR SALE

CONSULTING ENGINEERING FIRM

Owner desires retirement and offers complete organization and practice for sale, including the following:

1. An established civil engineering and surveying practice of more than ten years.
2. A going concern of engineers, surveyors and draftsmen.
3. Air-conditioned offices and drafting room complete with furniture, supplies and equipment.
4. Surveying instruments, survey station wagons, including supplies and equipment.
5. Catalogue file.
6. All tracings, standard drawings and map files, including extensive survey coverage of area served.
7. All aerial photography, photogrammetry, etc.

Owner will sell complete organization as listed for the amount that the business earned in net profit last year. The firm is located in a large and growing southeastern city. The amount of work performed can be greatly expanded if new owner so desires. **Write Box No. E1, Consulting Engineer, St. Joseph, Michigan.**

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All sizes to fit your gages
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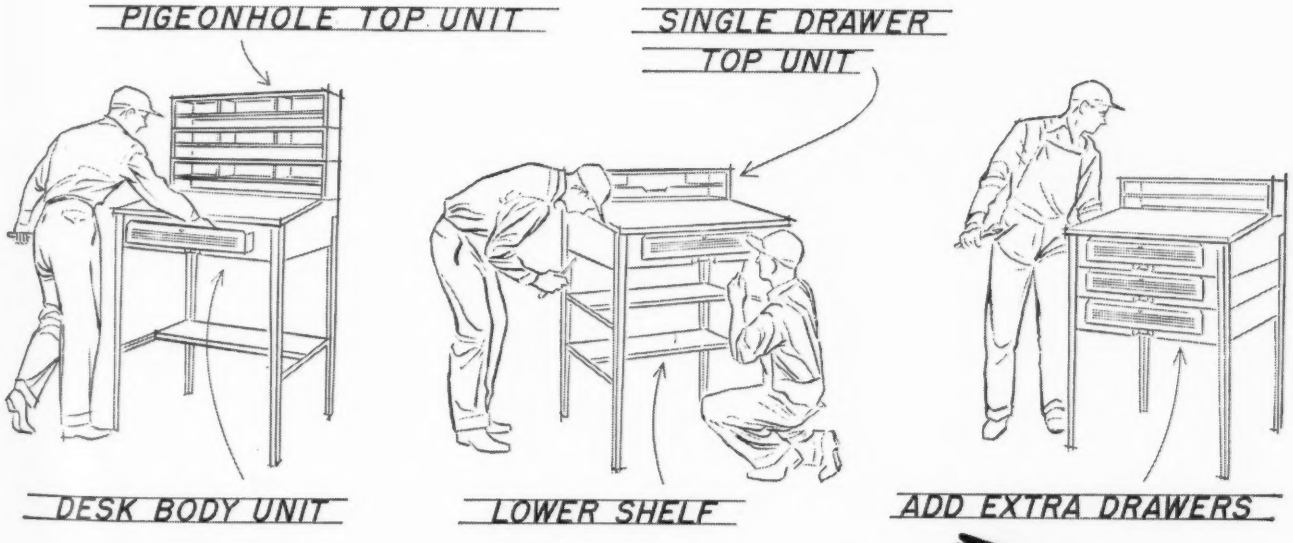
OR USE INTERCHANGEABLE PARTS TO CUSTOM BUILD THESE DESKS



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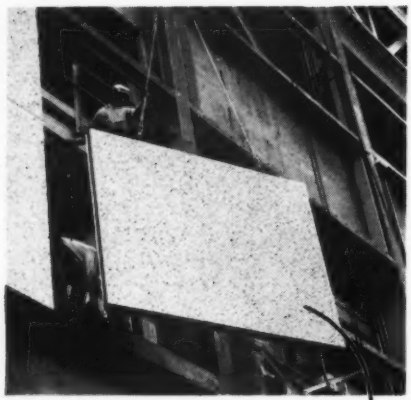
BENCHES (CABINET, WORK, UNIT) • STOOLS AND CHAIRS • SHOP DESKS • TOOL STANDS AND CABINETS • DRAWERS, DRAWER TIERS • STEEL CARTS • SHELVING

Building going up ...costs coming down

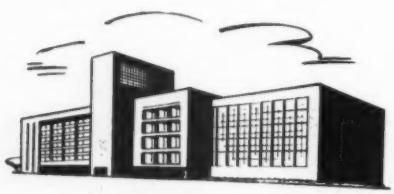


Marietta

CONCRETE WALL PANELS

Here's a new, modern building material that's slashing construction time and labor costs on every job. Marietta concrete wall panels are pre-cast in basic sizes either solid or with a rigid insulation core making them equal in "U" value to a 12" masonary wall. Cast-in metal inserts bolt directly to building framework and panels go smoothly together with tongue and groove fit for quick, easy erection in any weather. Pleasing architectural effects result from the broomed or colorful exposed aggregate exterior finishes.

Get the complete story on the many cost-saving advantages of Marietta wall panels . . . save as much as 30% in construction costs on your next building project. Marietta's engineering staff will assist you in your plans. Write for details and literature today.



THE Marietta

CONCRETE CORPORATION
Marietta, Ohio

BRANCH OFFICES: Baltimore 21, Md., Charlotte 6, N.C., Nashville, Tenn., Jamestown, N.Y.

Notes FROM ABROAD

Port Improvements

Improvements and extensions to the port of Mombasa, East Africa, are expected to cost about $30 million over a five-year period —increasing the handling facilities of the port by 50 percent. As Mombasa is the principal port of entry for both Kenya and Uganda, their economic life is dependent upon the facilities of this port.

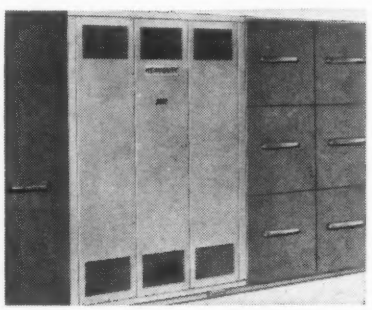
In 1955, seven deep-water berths were in operation, and two more were almost completed. But in December a movement in the sea bed caused a large part of the piling at one of the new berths to collapse with serious interruption to work on the other.

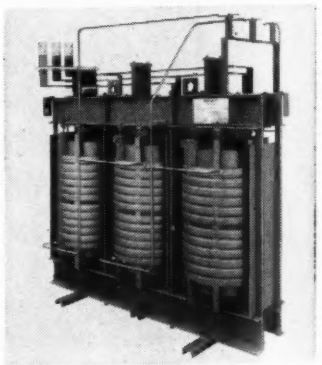
Proposals for the future include four more berths on the mainland at Kipevu. A 900-ft causeway is under construction to connect the port area of the island of Mombasa with the mainland. It will carry both rail and road traffic.

British up Oil Production

Oil production in the British Commonwealth during the first

SPECIFY HEVI DUTY TRANSFORMERS
for your unit substation requirements





Hevi Duty High-Voltage Transformer for Unit Substations. Wide range of types and sizes available.

Check these reasons for extra dependability

Liberal design assures **MAXIMUM PROTECTION** during peak operating periods.

RUGGED CONSTRUCTION. Notice the well-ventilated coils rigidly blocked in place. High-voltage insulation, heavy copper bus-bars and the other features which mean extra years of service.

THOROUGHLY TESTED and inspected to meet or exceed NEMA, ASA, and JIC Standards.

QUIET OPERATION permits indoor location close to the load. Because these transformers are designed to operate at a low flux density, noise levels are minimized.

Our engineers will be glad to cooperate with you in designing transformers to meet your exact specifications. Hevi Duty Transformers are built to the highest standards and are delivered promptly as scheduled.

Write today for our guide on "Dry Type Transformer Operation and Maintenance," a valuable source of transformer information.

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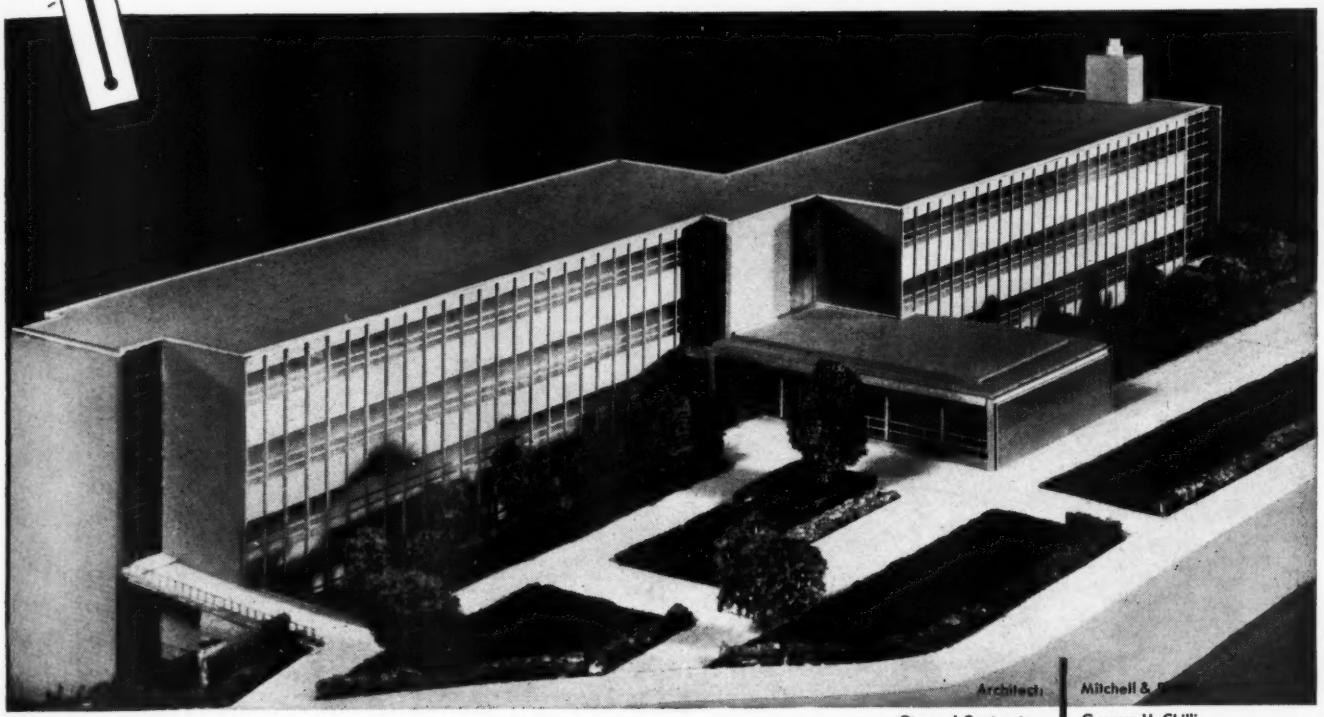
HEAT TREATING FURNACES HEVI-DUTY ELECTRIC EXCLUSIVELY
DRY TYPE TRANSFORMERS — CONSTANT CURRENT REGULATORS

COOLITE GLASS GETS ITS COLLEGE DEGREES



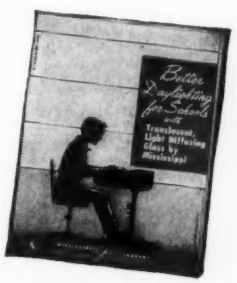
Architect:	Mitchell &
General Contractor:	George H. Chilli
Glazing Contractor:	Pittsburgh Plate Glass Company

Solar Heat and Glare Held to Minimum by Mississippi Glass in University Dormitory

Donner Hall, Carnegie Institute of Technology's new men's dormitory will be bright with daylighting without the unnecessary discomfort of excess solar heat. In keeping with modern architectural trends, this outstanding structure will feature extensive use of large areas of ¼" Mississippi Coolite, Heat Absorbing, Glare Reducing glass in both front and rear elevations. Under this excellent arrangement all rooms will be flooded with copious quantities of softly diffused, glare reduced daylight for maximum seeing comfort. The rooms will seem larger, more restful, more cheerful.

With its cool, blue color, translucent, light diffusing Coolite glass compliments the modern design of the building, and Coolite will help keep interior temperatures comfortable by absorbing up to 50% of solar heat rays. Students will see better, feel better, work better in the atmosphere created by Coolite-conditioned natural lighting.

When you build or remodel your school buildings, make better daylighting a part of your plans. Specify glass by Mississippi. Available in a wide range of patterns and surface finishes to meet any lighting need within any school budget.



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Mississippi constantly tests daylighting applications of its glass in a schoolroom erected on factory grounds. Results of these tests and assistance of Mississippi technicians are available to you upon request without charge.

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WORLD'S LARGEST MANUFACTURER OF ROLLED, FIGURED AND WIRED GLASS

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the gauge with

BUILT-IN SAFETY!

There's safety with the new USG Solfrunt Gauge . . . behind the face is a solid metal wall! In the event of a Bourdon tube rupture, pressure is released through the large rubber blowout back. The case is of aluminum.

Like USG's Supergauge . . . with proper application . . . the Solfrunt is built to last a lifetime.

ARC-LOC MOVEMENT—Rugged beyond compare . . . broad generated gear faces, deep stainless steel bushings. Calibration adjustments from rear by merely removing blowout back.

SEGMENT—Stainless steel, with nylon-faced gear section. Nylon-to-metal bond stabilizes the nylon against expansion and contraction . . . maintains accurate pitch diameter . . . assures proper mesh with stainless steel pinion under severe temperature and moisture conditions.

LEGEND ON DIAL—gives complete description of socket, Bourdon tube, and movement material for ready identification.

MICROMETER ADJUSTABLE SELF-LOCKING POINTER—permits accurate repositioning of pointer.

Solfrunt Gauges available in 4½", 6" and 8½" sizes. For complete information on case styles, materials of construction and connections, write for Publication 1819.

USG UNITED STATES GAUGE

Home of the SUPERGAUGE

Gauge Headquarters FOR OVER 50 YEARS

Division of American Machine and Metals, Inc., Sellersville, Pa.

nine months of 1955 totalled more than 19 million metric tons, an increase of 3 million tons over the corresponding period in 1954. Greatest part of the increase came from Canadian oilfields, while British Borneo and Trinidad production held steady. India, a relatively small producer, accounted for 250,000 tons during the period, a 30 percent rise. Total production for the Commonwealth has increased five-fold since 1946.

Chemical Plant Corrosion

The possibility of being able to tell from a recorder chart when corrosion in an operating chemical plant is about to occur has been explored in the Brown-Firth Laboratories, Sheffield, England, with promising results. The experiments were made in a pilot plant constructed in various steels and containing sulphuric acid that could be circulated under various selected conditions of temperature, pressure, contamination, and circulation rate.

Basis of the system is the fact that a corrodible metal and an acid solution in contact create an electrical potential. As long as this is above a critical value characteristic of the metal no corrosion occurs.

The Brown-Firth method was to use a multipoint valve voltage recorder to record continuously on one chart the potentials at different points in the plant, set up locally between a particular plant component and a standard calomel cell connected to it. The charts give immediate, graphical evidence of corrosive conditions.

New Refinery To Be Expanded

The 21,700-barrel-per-day refinery of the Commonwealth Refining Co. that went on stream March 1 at Ponce, Puerto Rico, will be expanded to increase the capacity to 55,000 barrels per day. The Lummus Co., who designed, engineered, and constructed the plant, will also have charge of the expansion.

Steam Generators to Spain

An annual output of 1.4 billion kwh will be furnished by three steam turbine generators ordered

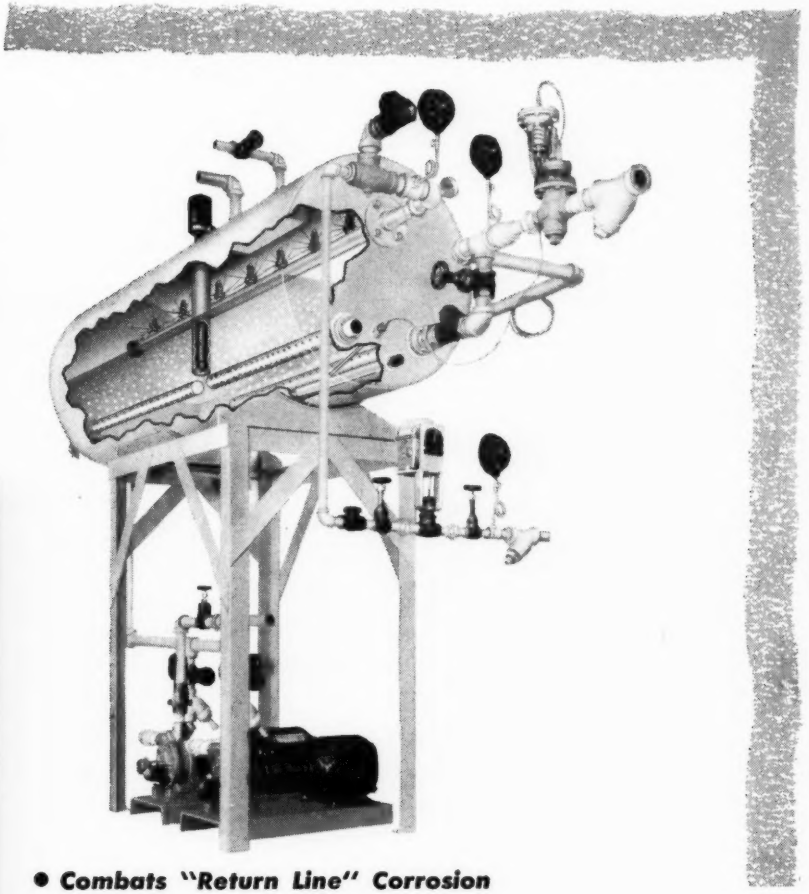
Now

"Budget-Priced" CORROSION PROTECTION

for the Small to Medium Steam Plant

The New

SCHAUB "03" *Deaerator*



- ***Combats "Return Line" Corrosion***
- ***Simpler in Principle***
- ***Gives Positive Oxygen Removal to .03 CC/Liter***

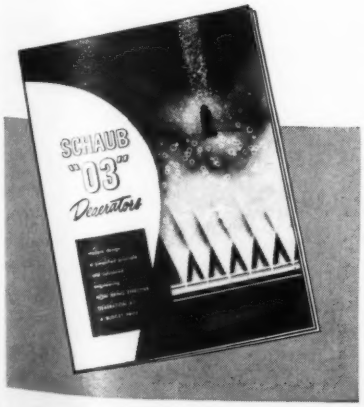
It is in plants of 3,000 to 30,000 lbs/hr boiler capacity — often operating at low pressure — that "return line" corrosion is most apt to rear its ugly head. This happens even when raw water make-up is negligible.

The Schaub .03 Deaerator was designed especially for these plants. It offers an effective and economical way to "clean up" boiler feedwater that will pay for itself many times over. It is equally applicable to high pressure installations.

The *big* difference in the Schaub .03 Deaerator is that it operates fully vented at *atmospheric* pressure. Noncondensible gases escape *immediately* and *completely*. Premium cost construction is eliminated, maintenance and operating costs are reduced to a minimum. Simple but effective spray-contact vent condensing prevents wasteful steam vapor loss. Pin-point temperature control, "live action" heating, and rust proof Chromasoid lining are exclusive features.

FRED H. SCHAUB ENGINEERING COMPANY

2103 South Marshall Boulevard • Chicago 23, Illinois



Write for Bulletin 1300 — and the full story on this low-cost, more efficient Deaerator.

Simple as it is, there's a lot more to the Schaub .03 Deaerator than can be told on this page. Bulletin 1300 is filled with facts for the operating or consulting engineer responsible for boiler feedwater deaeration. It tells the "hows" and "whys", and the basic differences in the Schaub .03 method. Mail the coupon now. No obligation, of course.

NOTE: The Schaub .03 Deaerator is designed for boilers up to 1,000 HP. or 30,000 lbs. per hour. For capacities up to 100,000 lbs. per hour at .005 cc/liter "zero-oxygen" removal, write for Bulletin 575, describing the Schaub Zero-Oxygen Deaerator.

FRED H. SCHAUB ENGINEERING COMPANY
2103 South Marshall Blvd., Chicago 23, Illinois

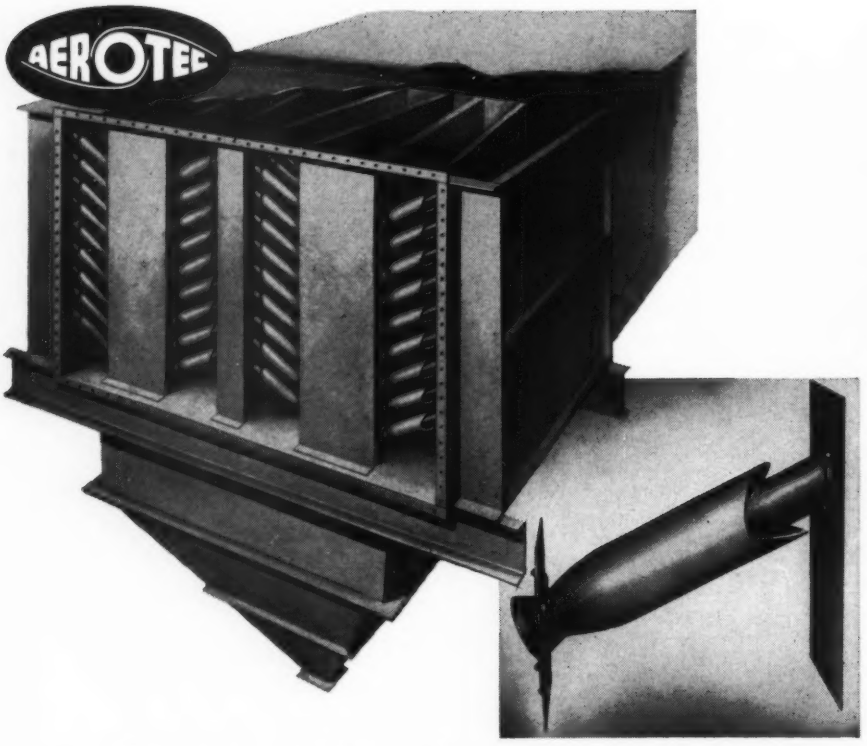
Please send me, without cost or obligation, my personal copy of your new Bulletin 1300 on Boiler Feedwater Deaeration.

Name.....

Company.....

Address.....

City.....Zone....State.....



longer life for

MECHANICAL DUST COLLECTORS

New Aerotec Tube Offers

- **Higher Efficiency**
- **Erosion Resistance**
- **Simplified Field Erection**
- **Low Maintenance**

The new Aerotec 5" Tube of white cast iron assures extremely high dust collector efficiency and in service far exceeds tubes of other basic metals. Accelerated tests conducted by Aerotec engineers have proven conclusively that white iron is superior in reducing wear, even when caused by the most highly abrasive particles.

Tubes are factory assembled into "building block" elements to simplify field erection. In addition, the inherent design of the 5" Tube reduces the possibility of plugging, even at low temperatures, or when the fuel has a high sulphur content. Years of research behind the development of this tube now assure a collector that requires minimum maintenance.

For information about the new Aerotec Tube, call or write to The Thermix Corporation, Project Engineers for Aerotec.

Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.
(Offices in 38 principal cities)
Canadian Affiliates: T. C. CHOWN, LTD., 1440 S. Catherine St. W., Montreal, Que.

Manufacturers
THE AEROTEC CORPORATION
Greenwich, Conn.

for installation in the new Central de Escombreras power station near Cartagena, Spain. Fuel oil for the units will be piped from the nearby Refineria de Petroleos de Escombraras refinery through a private pipeline.

Existing hydroelectric plants in the area have been unable to handle peak loads in drought years. Power from the new station will be furnished to Cartagena and the neighboring city of Valencia. The hydro-electric power now used in the Valencia area will then be shifted to Madrid.

The first shipment of portions of the generators was made in April from General Electric's Schenectady plant.

New Docks at Melbourne

New docks costing $67.5 million and capable of accommodating the largest ships are planned for the entrance to the River Yarra, Melbourne, Australia. Some 30 new berths, each costing $2.25 million, are part of the plan. The first five will be 750 ft long, with 70 ft wide aprons, and 150 ft wide transit sheds. Roads for commercial vehicles and large storage sheds will complete the scheme.

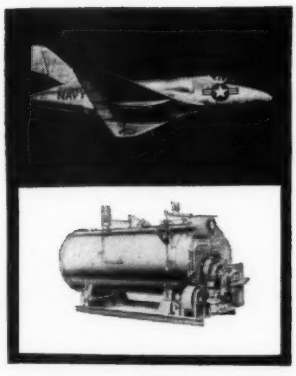
The CE in Australia

Consulting engineers' work on major construction projects in Australia is very limited since government authorities have their own permanent staff engineers who design and supervise their works. In fact, few major public works of any kind are let on contracts to outside firms except in cases where the Commonwealth Government is concerned.

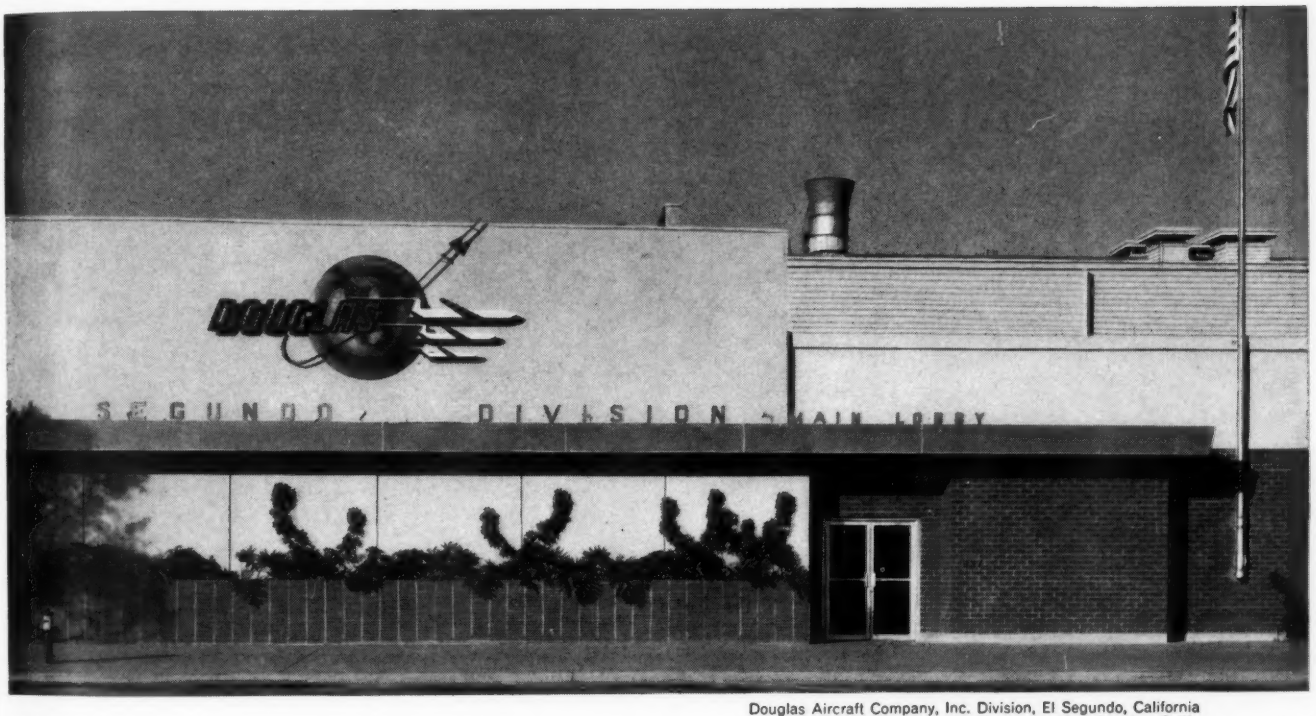
All state governments, except those in Victoria and South Australia, are under Labour Party control, and this political party is opposed to private contracts, believing in the use of day labor under control of government staff engineers.

Enlarge Engineering School

The British Government has decided to go ahead with plans for expansion of the Imperial College of Science and Technology, South Kensington, London. The $40-45 million project will double teach-



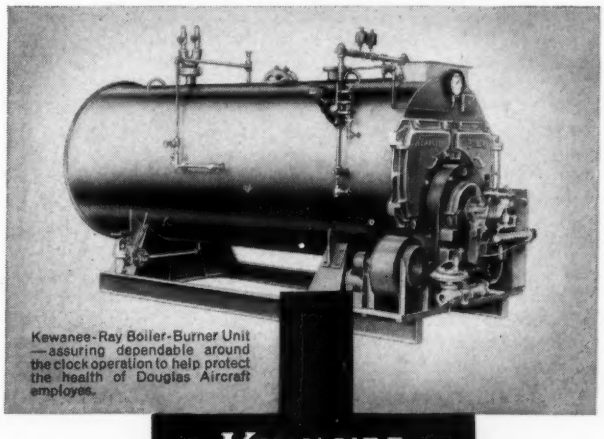
Sisters under the skin . . . when it comes to "cruising speed"



Douglas Aircraft Company, Inc. Division, El Segundo, California
Architect & Engineer: Holmes & Narver, Inc., Los Angeles, Calif.
Heating Contractor: E. Willardson, Inc., Los Angeles, Calif.

■ No one knows the importance of "cruising speed" operation in aircraft better than the Douglas Aircraft people. They know an airplane, to be efficient, to operate economically, to have longer life, must fly at "cruising speed." They know, too, there must be extra reserve power for take-off—for emergencies. So, when it came to boiler selection for the new A4D Skyhawk production facilities at their El Segundo, California Division, it was only natural they turned to Kewanee Reserve Plus Rated Boilers with 50% extra built-in power assuring "cruising speed" operation. For "cruising speed" means less strain—less wear. It means higher efficiency . . . it means lower maintenance and repair costs. Kewanee Boilers are rated on nominal capacity with reserve to take care of normal needs—meet emergencies of the present—fluctuating loads and future expansion. A boiler rated on maximum capacity, operating at constant top speed, requires more maintenance, constant attendance, and finer burner adjustment to maintain efficiency. So, choose Kewanee—for lower fuel and maintenance costs—more efficient "cruising speed" operation.

KEWANEE BOILER DIVISION of AMERICAN-Standard
101 Franklin Street, Kewanee, Illinois

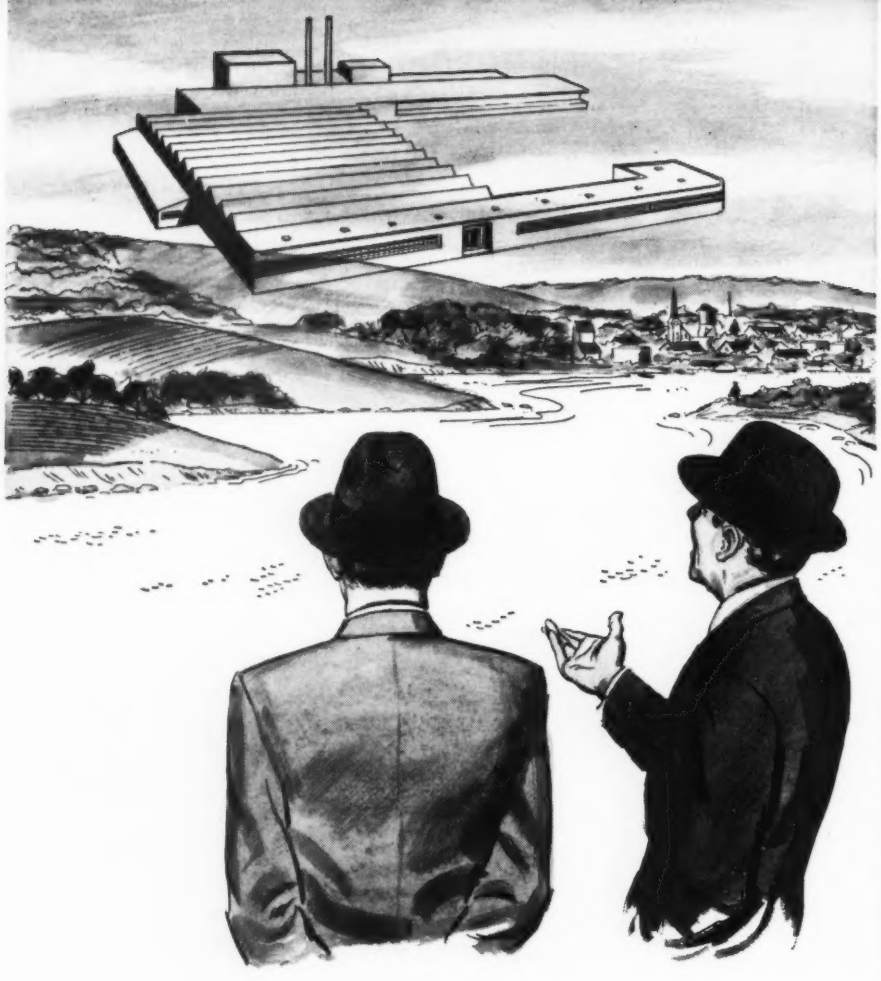


Kewanee-Ray Boiler-Burner Unit —assuring dependable around the clock operation to help protect the health of Douglas Aircraft employes.

KEWANEE
reserve plus rated

KEWANEE BOILERS

You can depend on Kewanee engineering



Water is vital in choosing a plant site—

Many desirable plant sites that qualified with all other requirements have been rejected because of a lack of adequate pure water supply.

Now, low grade water sources such as lakes, wells, or rivers, can be purified to drinking quality in any volume required and at moderate cost with the Sparkler Model SCJ Diatomite Water Filtering System. This makes it possible to use good plant sites formerly rejected because of the water problem.

All silica sand, algae, silt, organic matter etc. is completely removed with the Sparkler Diatomite filter and bacteria reduced 80% to 100%. The first cost is ½ that of a sand filter and occupies about 1/5 the floor area.

Single units are available up to 5,000,000 gal. per day output of filtered water, multiple units can be engineered for larger requirements, or continuous operations.

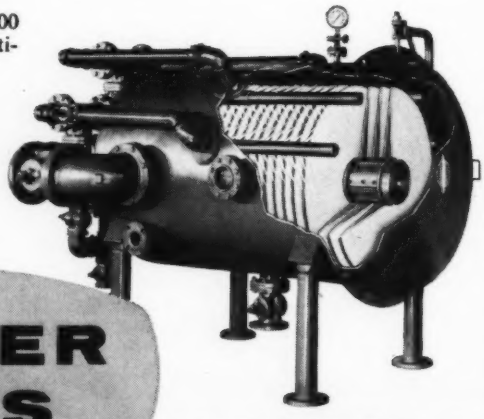
Sparkler has made rapid advancement in engineering and manufacturing of new filtration equipment for the chemical, sugar, beer, water, pharmaceutical, and many other industrial fields. Some of the largest plating plants in the world use Sparkler filters exclusively.

Engineering service and cost estimates available without obligation. A special consulting service is available to municipal committees who are engaged in attracting industrial development in a specific territory.

Write Mr. Dan Baldwin for personal service.

SPARKLER MANUFACTURING CO.
240 LAKE ST., MUNDELEIN, ILL.

Sparkler International Ltd. with Manufacturing plants in, Canada, Holland, Italy, Australia. • Service representatives in principal cities throughout the world.



SPARKLER FILTERS

For over 30 years filtration engineering and manufacturing has been our exclusive business.

ing capacity of the school to about 3000 students. Floor space will total 1,800,000 sq ft, providing new buildings for civil, mechanical, and electrical engineering. The new aeronautical and chemical engineering building is now almost complete.

Plans call for demolition of the Imperial Institute building, built by T. E. Collcut as a national memorial to Queen Victoria's 1887 jubilee year.

Tunneling Record Broken

In driving the Eucumbene-Tumut Tunnel, part of the Adaminaby Dam project in Australia, a team of miners working for Kaiser-Walsh-Perini-Raymond Construction Corp. drove a distance of 474 ft in six days, beating a previous record of 469 ft. This 14-mile tunnel runs from the Adaminaby Dam to the Tumat River, and is being driven from both sides at a weekly advance of 700 ft, considered well above average for the type of terrain.

Australian Steel Mill

The Broken Hill Co. has started construction of a new steel mill at Port Kembla, New South Wales, Australia. Scheduled for completion in late 1957, the $19 million mill will provide steel slabs for the hot strip and plate mill opened last year.

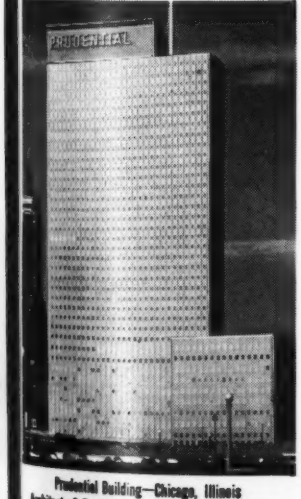
The new building will be 500-ft long and 100-ft high with an overhead crane spanning 112.5 ft.

Estimated Cost Rises

Total estimated cost of the Zambesi River hydroelectric scheme at Kariba, in Central Africa, has gone up from $255 to 340 million. However, comparing the cost of Kariba Dam with that of building additional thermal power stations to meet required future demands, consulting engineers on the project have estimated that over the period 1960 to 1971, the difference in favor of Kariba will be $30 million per year. The copper mines of Northern Rhodesia, long handicapped by power shortages, are lending the government $60 million to help finance the project.

Reconnaissance of transmission lines from the dam to the copper-

Specify RECO



Prudential Building—Chicago, Illinois
Architects & Engineers—Naess & Murphy, Chicago
General Contractors—G. A. Fuller Co., Chicago
Plumbing Contractor—M. J. Carboy, Chicago

Hot Water Insurance by RECO in Prudential's Mid-America Home Office

The Prudential Insurance Co. wanted plenty of hot service water for its new 41-story Mid-America Home Office Building. RECO handled the job.

Five RECO copper-lined hot water storage heaters keep 8000 gallons of rust-free hot water on tap for all 41 floors.

RECO can offer *you* this same hot water insurance. *Plus* the RECO guarantee of top quality, competitive price, dependable performance and quick delivery. Rely on RECO's *full* line of heat exchangers. For all your hot water needs—SPECIFY RECO.

RECOgnized for superior quality in 48 states and 16 foreign countries.

RECOmmended by leading engineers, contractors and architects.

RECO Hot Water Storage Heaters, Convertors and Instantaneous Heaters.

For free catalogs and the name of the RECO Representative nearest you, write:

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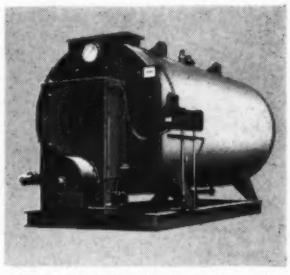
7th & Hospital Streets, Richmond 5, Va.
Phone—7-2611

Richmond Engineering CO., Inc.

Wherever Continental Automatic Boilers are installed, people are saving money.

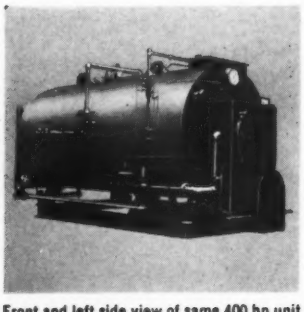


Front and right side view of one of four 400 hp Continental Automatic Boilers ready for shipment to four cement products processing plants.

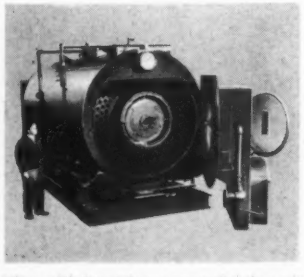
With a

Continental BOILER

You, too, can...

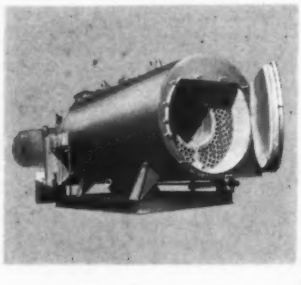


Front and left side view of same 400 hp unit — note simplicity of design.



View with front doors open showing gas burner assembly.

View with rear door open—showing furnace, return tubes and refractory-lined rear door.



SAVE ON INITIAL COST!

. . . for Continental Boilers are frequently *lowest* in purchase cost, yet feature highest quality workmanship, materials and controls.

SAVE FUEL COSTS!

. . . for Continental Radiant Flame Heating meets or beats other methods for fast, economical heat. And its unique "Spinning Gas Technique" affords maximum heat transfer and efficiency.

SAVE TIME, LABOR, MAINTENANCE!

. . . through Continental Boiler's simple, functional design that affords quick access to furnace and return tubes, easy cleaning and inspection, brief shut-down.

SAVE REPAIR AND REPLACEMENT COSTS!

Long, trouble-free service is made possible because all return tubes do equal work, affording balanced water circulation and uniform expansion.

Sizes 20 to 500 hp; 15 to 250 psi. Gas, oil or combination fired. Write for literature, and let B.E. bid on the next boiler you need.

Continental AUTOMATIC BOILERS

BOILER ENGINEERING *and Supply Company, Inc.*

1 Manavon St. • Phoenixville, Pa. • Phone 5832

belt and other potential users is well advanced and has indicated that about 900 miles of new line will have to be erected.

The three consultants on the project, Sir Alexander Gibb and Partners, London; A. Coyne and J. Belier, France; S.O.G.E.I., France, have formed a combine called Gibb, Coyne, Sogei (Kariba) Pty, Ltd., with headquarters at Salisbury, Southern Rhodesia.

Shuttering Left in Place

A Viennese engineer has patented a new method of wall construction, using a reinforced concrete framework, that satisfies both structural and thermal requirements of a main wall.

Wood frames consisting of covering boards and uprights are set on a foundation of concrete. The covering plates are screwed or nailed onto the frame, projecting from the frame on three sides. Steel rod reinforcements are placed in the hollow space for concrete supporting pillars formed by these plates. The upper part of the frame forms a hollow space for the concrete supporting beams.

Wooden parts may be impregnated for greater resistance to wear, or additional hollow spaces can be formed between the uprights and plates and then filled with concrete. Spaces not filled with concrete are filled with light materials such as sawdust, or left hollow as air spaces. For reinforcement of corner and edges during filling with concrete, clamps and loops of wire are used. Plates can be covered with Herallith or plaster.

The pillars can be prefabricated also, cast on the building site, and fixed together. The method is said to be suitable for all types of buildings, with a saving of up to 26 percent in the cost of construction on the project.

British Columbia

Under construction, or planned, are six bridges in a $258,500,000 spending program by the government of British Columbia. Of this, $80 million is earmarked for highways, bridges, and other capital works this year. Consulting engineers on the bridge projects are: Swan, Wooster and Partners;

Industrial Uses Widened by *New Features* of GPL *ii-TV*®

Many additional industries are benefited, many established industrial applications made easier, by new closed-circuit equipment which has been added to the GPL *ii-TV** System.

Have you a task that can be simplified by the instantaneous transmission of visual data? Like monitoring an assembly line or a remote machine? Controlling a complicated or dangerous process? Surveillance? Sales training? Stockholder relations? GPL *ii-TV* can help you solve these and hundreds of other business and industrial "seeing" problems.

The new GPL *ii-TV* equipment incorporates the same skilled design, the same top quality material and construction, for which all GPL television equipment is noted. When you use GPL *ii-TV* you are assured of outstanding picture quality, ease of operation and minimum upkeep. Moderate initial cost is often quickly offset by savings the equipment makes for you.

*The *industrial-institutional TV* System manufactured by General Precision Laboratory.

Basic *ii-TV* Camera—smaller than a football, weighs only 5 lbs. Shaped to fit into tight places. No special lighting needed; sensitive Vidicon tube picks up quality pictures at low light levels. Plugs into any AC wall outlet.

GPL *ii-TV* Camera mounted for remote-control, *indoor* use. Changes in direction—horizontal and vertical—adjustment of lens opening and focus can all be made from remote location. Full 360° camera viewing, 90° tilt.

GPL *ii-TV* Camera for remote-control, *outdoor* use. Weatherproof and explosion proof housings; full 360° camera viewing, 90° tilt.

GPL *ii-TV* Control Unit. 26 lbs. including case. Easily carried by one person. Wall or rack-mounted for permanent installation. Can be located remote from camera.

GPL *ii-TV* Switching Unit. Provides push-button selection for viewing the reports of four cameras, using only one camera control unit. With sequencing equipment, automatic remote surveillance of an entire production line or every step in control of a process is possible.

GPL Monitors or ordinary home TV receivers can be used. Circuit can include any number of receivers. Coaxial lines, easy to install, provide unlimited closed-circuit distribution.

GPL TV Projector. Multiplies the usefulness of a closed-circuit TV system by throwing bright, clear, movie-size pictures on a wall screen. Enables several hundred people to watch together.

Find out how GPL *ii-TV*'s built-in superior features can help you. Write:

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For detailed information on GPL *ii-TV*

contact any of the following

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  971 Main Street
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  Tel: Twinbrook 3-1400
  TERRITORY: Massachusetts, Rhode Island, Connecticut, New Hampshire, Maine, Vermont, Northern New York

- **W. A. Brown & Associates, Inc.**
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  Tel: Overlook 3-6100 3-6333
  TERRITORY: Florida, Georgia, North Carolina, South Carolina, Maryland, Delaware, Alabama, Mississippi, Tennessee, Virginia, West Virginia

- **M. P. Odell Company**
  2536 Euclid Avenue
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  Tel: Prospect 1-6171
  TERRITORY: Eastern Michigan, Western Pennsylvania, Ohio

- **Hugh Marsland & Company**
  6405 North California Avenue
  Chicago 45, Illinois
  Tel: Ambassador 2-1555 2-1556
  TERRITORY: Western Michigan, Indiana, Illinois, Iowa, Nebraska, North Dakota, South Dakota, Minnesota, Wisconsin, Kansas, Missouri, Kentucky

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  TERRITORY: Canada

or

General Precision Laboratory
Incorporated

- **Main Office**
  (including New York District Office)
  63 Bedford Road
  Pleasantville, New York
  Tel: Pleasantville 2-4100

- **Mid-Atlantic District Office**
  The Benson, Suite 111B
  Jenkintown, Pennsylvania
  Tel. Turner 4-3476

- **Mid-Western Office**
  188 West Randolph Street
  Chicago, Illinois
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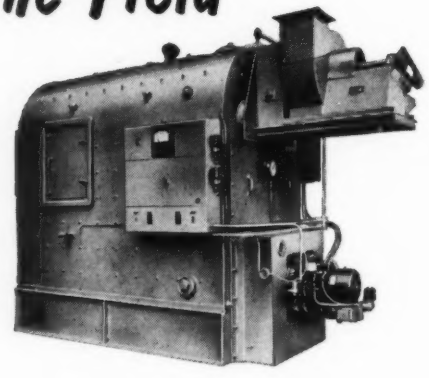
Compare International Water Tube Package Boilers with the Field



- Ample Furnace Volume—low heat release rates
- Convertible to Coal Firing
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Package boilers can also be shipped, less burner and controls, for installation by local contractors in accordance with International's standard package specifications.

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It will pay you to specify International, the boilers with extra profits built in. We will gladly send these International Bulletins:

No. 600 —Water Tube Package Units
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THE INTERNATIONAL BOILER WORKS CO.

Steel Firebox Heating & Power Boilers Low & High Pressure Water Tube Package Boilers • International-LaMont Forced Recirculation Generators • ASME Code Pressure Vessels & Welded Products.

800 Spruce St. East Stroudsburg, Pa.

Phillips, Baret and Partners; and A. B. Sanderson and Co., Ltd. The first two firms are from Vancouver, B.C., and the third is from Victoria, B.C.

Icelandic Cement Plant

American agricultural commodities sold to Denmark by the International Cooperation Administration last year will finance the construction of Iceland's first cement plant. The triangular financing arrangement began last year when ICA sold Denmark $4 million worth of surplus U. S. agricultural commodities, including $2.3 million worth of coarse grains — corn and grain sorghums — for animal feed. The money paid by Denmark for the grain was then loaned back to Denmark by the U.S., and in turn will be loaned to Iceland by Denmark to finance the construction project.

Materials, equipment, and engineering services to build the new plant will be supplied by the Danish firm of F. L. Smidth and Company, the lowest international bidder. The Iceland government will finance labor and other local costs on the project.

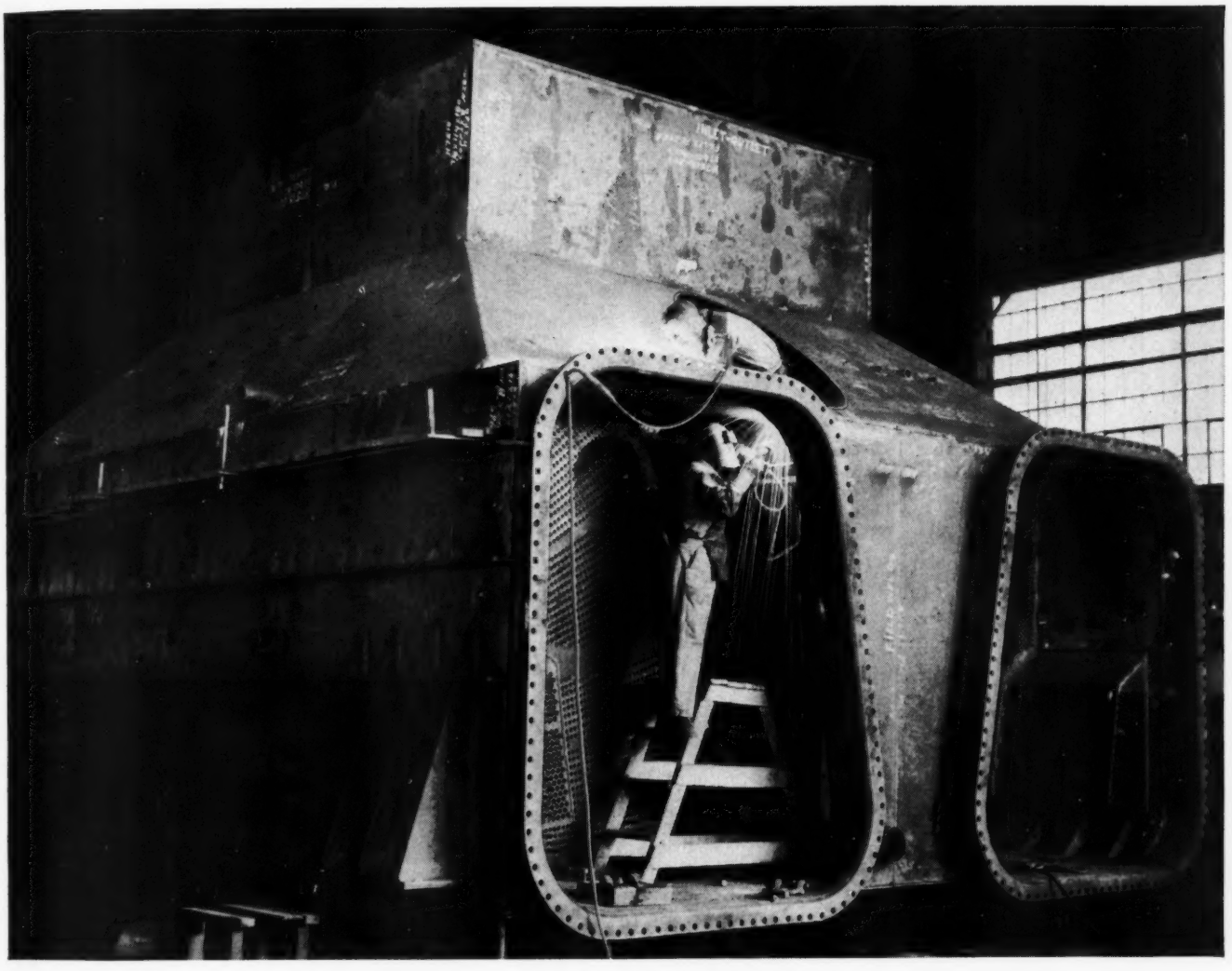
The U. S. loan to Denmark is repayable in 15 years with payments contingent on repayments to Denmark on her parallel loan to Iceland.

Engineers to Australia

Two U. S. Bureau of Reclaimation engineers have joined the group of experts advising on Australia's development of the Snowy Mountains hydroelectric project.

Frank E. Goehring, construction engineer on Pactola Dam in South Dakota, will advise Australian personnel engaged in all aspects of heavy construction. Fred E. Cronwell, design engineer at the Bureau's Engineering Center in Denver, Colo., will give guidance in matters related to design of dams, hydroelectric plants, and tunnels.

The Snowy Mountains scheme includes seven major dams, diversion structures, 85 miles of major tunnels, and 17 power plants with a total capacity of 2.8 million kilowatts. ▲▲



this surface condenser was specially designed to save space

Pictured above in the final stages of construction is a surface condenser designed by Lummus to save much-needed space at the White River Station of the Indianapolis Power & Light Company. The rectangular shape permits low headroom installation. Bayonetting a low pressure stage heater in the dome saves even more space.

This condenser, about to be placed in operation as unit #6 at the White River Station, has a total of 50,000 sq. ft. of tube surface, and was furnished complete with circulating water and condensate pumps and drivers, and a Lummus-designed air ejector unit.

Lummus was highly commended by Gibbs and Hill Inc.—the consulting engineers—and by the customer for efficient handling of engineering details, and for the workmanship which went into the building of the condenser in the Lummus plant. Lummus has been retained to build a second, duplicate unit at Indianapolis' Harding Street Station.

By working closely with consultants and the customer, Lummus engineers were able to solve a knotty space problem frequently encountered in power station design. These same men would be pleased to work with you on similar problems. Call on them.

THE LUMMUS COMPANY, 385 Madison Avenue, New York 17, New York. *Engineering and Sales Offices:* New York, Houston, Montreal, London, Paris, The Hague, Bombay. *Sales Offices:* Chicago, Caracas. *Heat Exchanger Plant:* Honesdale, Pa. *Fabricated Piping Plant:* East Chicago, Ind.

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HEAT EXCHANGER DIVISION ®

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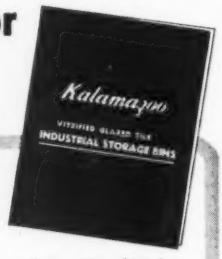
THE LUMMUS COMPANY, HEAT EXCHANGER DIVISION • 385 MADISON AVENUE, NEW YORK 17, N. Y.

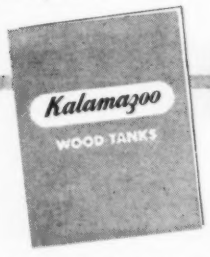
Kalamazoo

offers 3 bulletins to help you plan STORAGE BINS, TANKS, CHESTS for Bulk Materials in Process or Storage



1

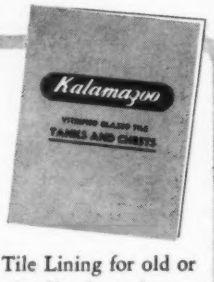
Shows cross sections and details of Kalamazoo Industrial Storage Bin construction plus advantages of maintenance-free Kalamazoo Vitrified Glazed Tile. Application photos.



2

Eight pages describing round and rectangular Wood Tanks, Special Vats, Flumes, Ducts and Frost-Proof Wood Boxing, used in processing and bulk storage. Construction details, numerous examples.

3



Illustrates Kalamazoo Split Tile and Unit Tile for straight or curved tanks and chests. Also Tile Lining for old or new tanks, pits. Applications shown.

Fill out and mail coupon today.

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Kalamazoo TANK AND SILO CO.
539 Harrison Street
Kalamazoo, Michigan, Phone 5-2141

- ☐ 1—Tile Storage Bins, Bul. 1153-B
- ☐ 2—Wood Tanks, Bul. 655-W
- ☐ 3—Tile Tanks, Chests, Bul. 1055-T

Name_____
Title_____
Firm_____
Street_____
City_____ Zone____ State_____

Kalamazoo | TANK & SILO CO.

New Projects Reported

By Consulting Engineers—

ARIZONA

Parsons, Brinckerhoff, Hall & Macdonald. Fourth engineering and economic report, covering economics of constructing two 100,000 kw natural gas-fired units at Aqua Fria steam plant, near Phoenix. $25,000,000 (est.) Client, Salt River Project Agricultural Improvement and Power District, Ariz.

CONNECTICUT

Fred S. Dubin Associates. Humane Society, Hartford, Conn. $300,000. Client, architect, Schutz & Goodwin, Hartford, Conn.

Sacred Heart Parochial Group, church, school, convent, Groton, Conn. $1,200,000. Client, architect, Painchaud & Ryder, Madison, Conn.

Hartford County Court House addition, Hartford, Conn. $400,000. Client, architect, Berenson-West.

Parsons, Brinckerhoff, Hall & Macdonald. Survey and design for a four-lane divided highway for the relocation of U.S. Route 6 in Danbury, Conn. Client, City of Danbury, Conn.

FLORIDA

Michael Baker, Jr., Inc. Design of thirteen miles of extension of Florida Turnpike from Fort Pierce to St. Petersburg. $5-7,000,000. Client, The Florida Turnpike Commission.

GEORGIA

Parsons, Brinckerhoff, Hall & Macdonald. Study to determine most practical method of runway rehabilitation at Dobbins Air Force Base, Marietta, Ga. Client, Lockheed Aircraft Corp.

INDIANA

Consoer, Townsend and Associates. Survey and engineering report to recommend immediate and long range improvements of overloaded sewer system and sewage treatment plant. Client, City of Fort Wayne, Ind.

Wayne A. Becker, Consulting Engineer. 35 x 75 ft swimming pool and separate wading pool, dressing room facilities, reinforced concrete including filter plant, circulating system, pool equipment, etc. Client, Connersville Country Club, Connersville, Ind.

Gary STAINLESS STEEL WELDED GRATING

Particularly suited for conditions such as in the chemical and petroleum industries. Available in many types of stainless from Gary Type GW-75A (¾" x ⅛" main bar, ¼" hexagonal cross bar) to Type SGW-225 (2¼" x 3/16" main bar, 5/16" hexagonal cross bar). Send today for full details.

Write for Catalog CE-56

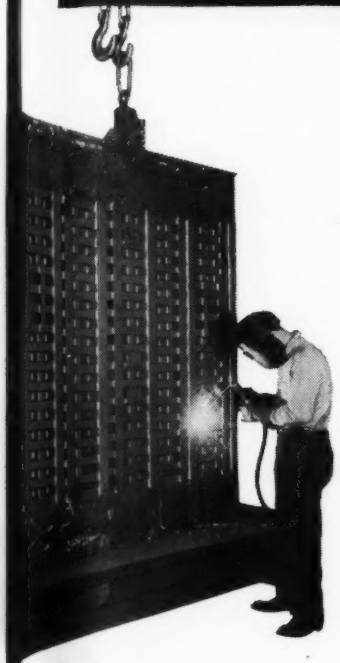
Standard Steel Spring Division

ROCKWELL SPRING AND AXLE CO.
4015 East Seventh Avenue • Gary, Indiana

HOW USS "T-1" STEEL IMPROVES THESE PRODUCTS...

..Lops Off 1,047 Lbs.

Trays for ore clean-up buckets need tremendous resistance to impact, abuse, and abrasion. Blaw-Knox Company, Pittsburgh, Pa., found that they weigh half a ton less, and cost less to fabricate when made from USS "T-1" Steel plate instead of heavy steel castings.



Three Ways Better . . .

International Nickel Company of Canada expects USS "T-1" Steel to increase the service life, to reduce the maintenance, and lower the long-term cost of ore cars like this one; because "T-1" Steel has far greater strength, toughness, and resistance to abrasion than steel used previously. The car builder, Canadian Car and Foundry Co., Ltd., has had no difficulty fabricating this very strong alloy steel.

...534 Easier Welds

This printing press bedplate manufactured by Graver Tank & Manufacturing Co., Inc., must be welded in 534 places. High alloy steel with the needed strength was very difficult to weld. But USS "T-1" Steel is easy to weld . . . and has the needed strength to keep these bedplates, used on high-speed printing presses, as lightweight as possible.

HOW USS "T-1" STEEL CAN HELP YOU

The great strength and toughness of USS "T-1" Steel (90,000 psi, minimum yield strength) helps you to increase the capacity and durability of power-shovel buckets and storage tanks without increasing weight.

Its excellent weldability enables you to fabricate large equipment out in the field without heat treatment. It thus reduces fabricating and shipping costs and speeds up construction.

Its unusual toughness at sub-zero temperatures improves service life of equipment that must take impact, abrasion, and abuse in all weather.

USS "T-1" Steel also gives you good creep-rupture strength to 900°F. It often can be substituted for more expensive steels that are more difficult to fabricate. There is a place for "T-1" Steel somewhere in your designs. Write, wire, or phone for complete information. United States Steel, Room 5292, Pittsburgh 30, Pa.

UNITED STATES STEEL CORPORATION, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
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USS

See The United States Steel Hour. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

UNITED STATES STEEL

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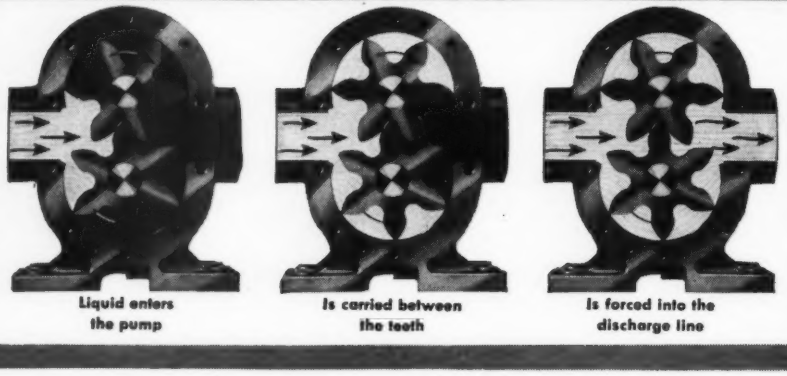
"THE PRINCIPLE OF THE THING"
MEANS ANYTHING TO YOU
then look to ROPER

only 2 moving parts
HELP MAKE ROPERS DEPENDABLE



SMOOTH AND QUIET FLOW...
EQUAL EFFICIENCY IN EITHER DIRECTION

HOW IT OPERATES — The unmeshing of the gears produces a vacuum, drawing the liquid into the tooth spaces. The liquid is carried between the teeth and case to the opposite side of the pump. The meshing of the gears forces the liquid into the discharge line. This is a positive displacement pump. The Roper principle is simple in design. It has only two moving parts — equal size pumping gears — operating in a case with proper amount of clearance to promote high efficiency and long life.

GEO. D. ROPER CORPORATION 645 Blackhawk Park Ave., Rockford, Ill.

Send for helpful handbook
"HOW TO SOLVE PUMPING PROBLEMS"

ROPER Rotary Pumps

MASSACHUSETTS

Fred S. Dubin Associates. Littleton Junior-Senior High School, Littleton, Mass. $1,200,000. Client, The Architects Collaborative.

Pioneer Valley Junior-Senior High School, Northfield, Mass. $1,246,000. Client, The Architects Collaborative.

Lowell Elementary School, Lowell, Mass. $500,000. Client, architect, Hugh Stubbins Associates.

Yewell Associates, office building, Lexington, Mass. $75,000. Client, architect, Charles H. Cole.

MICHIGAN

Parsons, Brinckerhoff, Hall & Macdonald. Preliminary designs, contract plans, specifications, and general supervision of construction for raw water tunnel—part of a new water supply system for the southwestern part of Wayne County. Client, Wayne County, Mich.

Yamasaki, Leinweber & Associates. County Jail, Grand Rapids, Mich. $1,500,000. Client, Kent County Building Commission.

Wayne Junior High School, Wayne, Mich. $1,000,000. Client, School Board.

Livonia Junior High School, Livonia, Mich. $1,000,000. Client, School Board.

McNamee, Porter & Seeley. Waste treatment and water supply at Manistee, Mich. plant. $1,300,000. Client, American Box Board Co.

Water filtration plant. $3,000,000. Client, City of Midland, Mich.

Jones, Henry & Williams. Sewage plant additions. $2,000,000. Client, City of Battle Creek, Mich.

Steven Antonoff & Associates. Highway Grade Separation on Farmington-Brighton Expressway carrying US-16 (reloc.) over access road to Kensington Park Area in Oakland County. $265,000. Client, Michigan State Hwy. Dept.

Highway Grade Separation carrying US-16 (reloc.) over Orchard Lake Road in Oakland County. $175,000. Client, Michigan State Hwy. Dept.

Highway Grade Separation on Farmington-Brighton Expressway carrying Haggerty Road over US-16 (Reloc.) in Oakland County. $165,000. Client, Mich. State Hwy. Dept.

Highway Grade Separation on Farmington-Brighton Expressway carrying Meadowbrook Road over US-16 (Reloc.) in Oakland County. $155,000. Client, Mich. State Hwy. Dept.

MINNESOTA

Lindsey Engineering Co. Swimming pool and bathhouse, 40 x 100 ft. $35,000. Client, City of Gaylord.

Ballinger-Messerole Co. Design of layout and operation for 200,000 sq ft distributing warehouse to be located in the Minneapolis area. Client, Minneapolis-Honeywell Regulator Co.

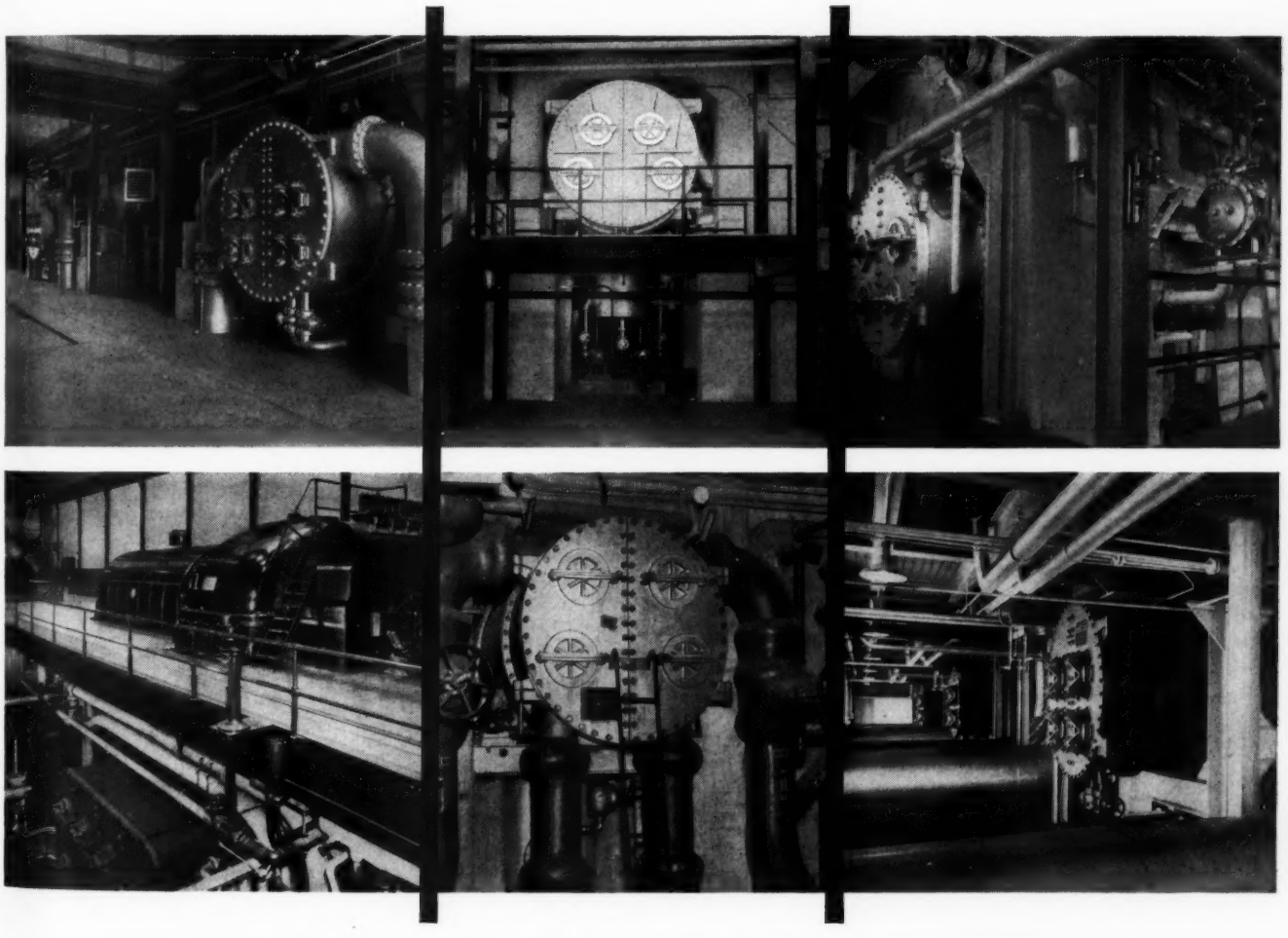
MISSOURI

Fred S. Dubin Associates. St. Louis

the fame of a good product travels far . . .

ROSS SURFACE CONDENSERS

serve power plants everywhere



Pre-eminence of Ross engineering and manufacturing has won many customers . . . and kept them . . . here and abroad.

Public utilities, municipalities, industries, institutions, office buildings . . . some equipped with large twin bank designs, others with smaller single bank units . . . number among Ross installations which date back 40 years.

Long a leading, exclusive producer of heat exchange and condensing equipment . . . long a pace-setter with major innovations . . . Ross has a versatile experience to offer in the interpretation *and fulfillment* of your requirements. Consulting engineers, contractors, architects or plant men . . . whoever specifies . . . all like to work with Ross engineers in the solution of condensing and heat exchange problems.

New Bulletin 8.2K1 gives you the reasons why. Write for your copy, please. Ross Heat Exchanger Division of American-Standard. 1472 West Ave., Buffalo 13, N. Y. In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.

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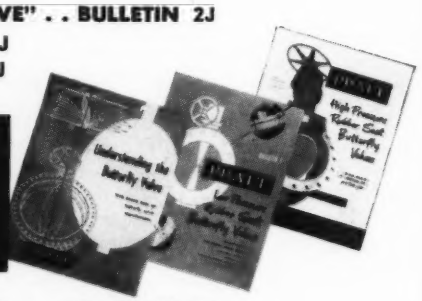
125# Valves...drop tight!

Will not "freeze" from corrosion— *Corrosion can't hinder operation.* Disc edges are chrome plated or stainless steel and close into a thick rubber seat. These features plus self lubricated bearings and stainless steel shafting make it impossible for valves to "corrode tight" either open or shut.

Full 90° closure into Rubber Seat— The disc is slightly larger than the inside of the rubber seat and thus actually displaces the rubber when closed. The ratio of seat thickness to disc indentation insures drop-tight shut off and avoids permanent set. The seats are secured in the valve body by removable keeper segments.

Saves space. Even these high pressure valves are compact, easy to install, and require little head room. Available from 10" to 72" diameter in either cast iron or fabricated steel. A variety of operator types can be supplied.

WRITE FOR COMPLETE DETAILS:
"UNDERSTANDING THE BUTTERFLY VALVE" . . BULLETIN 2J
LOW PRESSURE VALVES . . BULLETIN 1J
HIGH PRESSURE VALVES . . BULLETIN 4J



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RUBBER SEAT
Butterfly Valves

Henry Pratt Company, 2222 S. Halsted St., Chicago 8, Ill. Representatives in principal cities

Civic Art Museum and Auditorium. $1,000,000. Client, architect, Murphy & Mackey, St. Louis, Mo.

St. Thomas Aquinas High School, St. Louis, Mo. $2,000,000. Client, architect, Hellmuth, Obata & Kassabaum, St. Louis. Engineer, Ferris & Hamig.

Medical Clinic, George Washington University, St. Louis, Mo. $2,000,000. Client, architect, Murphy & Mackey.

The Francis Engineering Co. Additions to municipal electric plant including 1600 hp diesel engine. Client, City of Thayer, Mo.

NEW JERSEY

Fred S. Dubin Associates. Grace Lutheran Church and school, Teaneck, N.J., $1,000,000. Client, architect, Paul Schweikher.

Howard Johnson Motor Lodges, Springfield, N.J., many other locations throughout country. Average cost approximately $200,000. Client, Carl Koch Associates, Architects.

NEW MEXICO

Bridgers & Paxton. Miscellaneous buildings for Air Force bases in Albuquerque, N.M. district, including Hokaman, Kirkland, Walker, and White Sands. Totals several million dollars, exact amount unknown. Client, architects, W. C. Kruger or K. S. Clark.

Administration building, Sandia Base, Albuquerque, N.M. $1,000,000. Client, Max Flatow-Jason Moore, architects.

Gymnasium and field house, University of New Mexico, Albuquerque, N.M., under construction. $2,000,000. Client, architects, Meem-Zehner and Holein.

NEW YORK

Fred S. Dubin Associates. Utica New York Art Museum. $1,000,000. Client, architect, Philip C. Johnson.

Parsons, Brinckerhoff, Hall & Macdonald. Preliminary plans for Fuhrmann Blvd.-Hamburg Turnpike Viaduct. Client, Dept. of Public Works, State of New York.

Design, contract plans, and specifications for approximately 10,000 ft of sewers. Client, Whitehall Road Sewer District, Albany, N.Y.

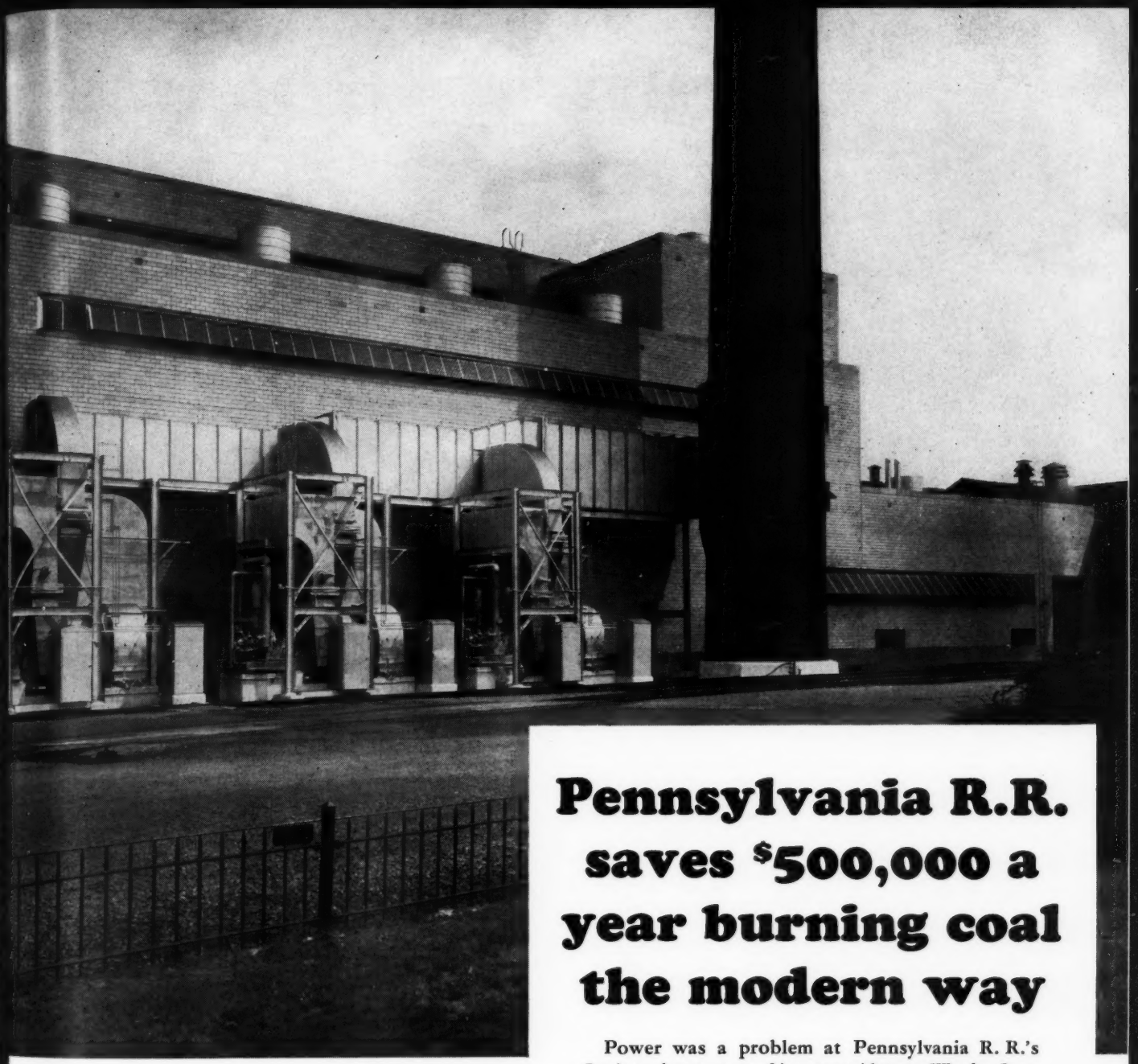
Schmidt, Garden & Erikson, project architects and engineers, and **Carson & Lundin,** consultants. New administration, personnel, and research and development buildings, $5,000,000. Major improvement to existing building. Expansion of production facilities, $5,500,000. Client, Carrier Corp., Syracuse.

Seelye, Stevenson, Value & Knecht. Suffolk County office building, Riverhead, N.Y. (structural only). $5,030,000. Client, Louis E. Jallade, Architect.

Store for S. H. Kress & Co., Hempstead, New York (structural only). Client, S. H. Kress & Co., New York.

Southeast Yonkers High School, Yonkers, New York (structural only). $5,000,000. Client, LaPierre-Litchfield Assoc., Architect, New York.

Warwick Junior-Senior High School,



Pennsylvania R.R. saves $500,000 a year burning coal the modern way

Power was a problem at Pennsylvania R. R.'s Juniata shops, part of its great Altoona Works. Low steam pressure was creating costly production delays; electric power failures meant additional delays; obsolete fueling methods resulted in troublesome flyash emission and other problems.

So Pennsy engineers consulted with Gibbs & Hill, Inc.—designers and constructors for the project—and modernized the power plant. Today three 60,000-lb.-per-hr. 600 psi coal-fired boilers supply steam to the shop area at 150 psi after it has driven two 1,500-kw turbine-generators. Between an adequate steam supply and reliable by-product electrical services, production delays have been eliminated. Air pollution is a thing of the past. Modernization of fuel handling has cut manpower costs. And today efficient operation plus lower fuel costs save Pennsylvania Railroad a half million dollars a year!

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

NATIONAL COAL ASSOCIATION
Southern Building, Washington 5, D. C.

Note to Consulting Engineers:

Many companies planning a new power plant, or the remodeling of a present one, consult an engineering firm on its design and construction. When you have such a project, our Engineering Department will be glad to assist you in your fuel cost survey with any coal information you may require. In most cases, for the reasons listed below, the use of coal results in substantial savings in increased efficiency and fuel economy through the years.

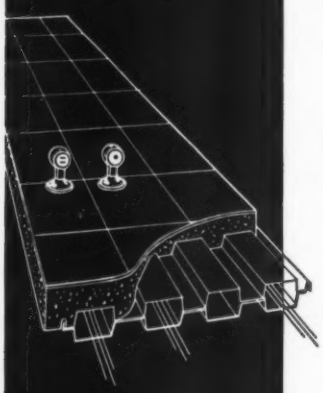
facts you should know about coal

In most industrial areas, bituminous coal is the lowest-cost fuel available • Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar • Automatic coal and ash handling systems can cut your labor cost to a minimum. Coal is the safest fuel to store and use • No smoke or dust problems when coal is burned with modern equipment • Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

112-year-old insurance company looks ahead with new functional design

Uses Milcor Celluflor to get freedom of floor space — and flexibility of electrification

No matter how complex the electrical system, Celluflor has ample capacity to handle it. Cells, spaced on 6-in. centers, permit the installation of service outlets at any point on the floor.



The State Mutual Life Assurance Building in Worcester, Mass. is unique in two respects:

1. It has private offices located in the center of each floor — and general office space in the perimeter. This arrangement provides large expanses of work areas free of all obstructions.
2. The building can't be electrically outdated. Milcor Celluflor provides power pathways in the floor to accommodate all of today's wiring and permits easy addition of possible new services in the future — data-processing and office automation circuits, closed-circuit TV hook-ups, and many others.

For greater flexibility in placing private-office partitions, the central area of each floor in this building has no columns. Style BC Celluflor — used throughout — is ideally suited to this type of construction. It combines light weight with great strength — and carries floor loads over long spans with fewer structural supports.

Write for Catalog 270, for planning help.

architects-engineers
Cram & Ferguson, Boston, Mass.

general contractor
Turner Construction Co.,

MILCOR® Celluflor

Cross-section showing Celluflor installation in State Mutual Life Assurance Building.
P = power; T = telephone; S = signal.

INLAND STEEL PRODUCTS COMPANY
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DALLAS • DETROIT • KANSAS CITY • LOS ANGELES • MILWAUKEE
MINNEAPOLIS • NEW YORK • ST. LOUIS M-1918

Warwick, New York (structural only). $1,600,000. Client, Coffin & Coffin, Architect, New York.

OHIO

G. M. Goldsmith. Foundation for concrete mixing plant. $20,000. Client, Richter Concrete Corp., Cincinnati.

Store building, Cincinnati, Ohio. $30,000. Client, Hermes Brothers.

Michael Baker, Jr., Inc. Engineering report to determine location, type of construction, and costs for construction of new highways in Akron area. State Route 8 between Akron and Canton—20 mi; State Route 8 from Akron Expressway to Boston Heights—15 mi; and U.S. 224 from U.S. 21 to Portage County Line—4 mi. Client, Ohio Dept. of Hwys.

Engineering report to determine new location, type of construction, and costs for construction of U.S. Route 22 for 65 miles between Steubenville and Cambridge. Client, Ohio Dept. of Hwys.

C. M. Maratta & Associates. Design and construction supervision of 25,000 sq ft combined factory and office building on Route 62, near Canton, Ohio. Client, Campro Co.

H. Emerson Thomas & Assoc., Inc. Liquified petroleum gas plant, Sandusky. $35,000. Client, Ford Motor Co.

Wayne A. Becker. Two playground, swimming, and wading pool projects. Reinforced concrete (alternate steel plate). No filter plants. Pools to be fill and draw type. $30,000, Mt. Airy Playground; $30,000, Grant Playground. Client, Recreation Commission of City of Cincinnati, Ohio.

Emmet J. McDonald. Delia Estates, Akron, Ohio. Subdivision, paved streets, sanitary sewer, storm sewer, water, pump station, and force main. $460,000. Client, Algernon Blair, Inc., Montgomery, Ala.

Fairlawn Heights Estates, Akron, Ohio. 400 acre subdivision with paved streets, sanitary sewer, water, pump station. $500,000. Client, Fairlawn Building & Realty Co.

Country Club Estates, Ohio. 29 acre subdivision with paved streets, sanitary sewers, storm sewer, and water. $85,000. Client, Fairlawn Building & Realty Co., Akron, Ohio.

Sand Run Village, Ohio. Subdivision, paved streets, sanitary sewer, water. $160,000. Client, D and J Co., Akron.

OKLAHOMA

Pate Engineering Co. Revision to the main collecting sewage line and a complete treatment plant. $200,000. Client, City of Drumright, Okla.

New water supply and treatment plant including softener. Revisions to sewage collection system and a complete treatment plant. $450,000. Client, City of Eufaula, Okla.

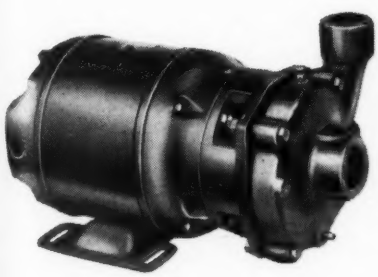
OREGON

Ray W. Preston, Electrical Engineer. Intermediate Correctional Institution. Electrical design. St. Paul. $5,000,000.

to solve your pump problems!

No matter what you call him . . . no matter what your needs . . . there's *one* man capable of doing *all* the necessary work to solve your pump problems. He's your WEINMAN Centrifugal Pump Specialist! His combined, thorough knowledge of *all* pumping problems . . . his ability to quickly and correctly provide the right solution to any new pumping requirement, is what makes a WEINMAN Pump Specialist so valuable to you.

And it's this same knowledge incorporated into WEINMAN PUMP design and manufacture, that makes a WEINMAN PUMP so superior in dependability, efficiency and economy! The years of experience and "know-how" accumulated in the field, by WEINMAN Pump Specialists, are built into every WEINMAN PUMP! That's why, from Impeller to Shaft Seal, a WEINMAN PUMP is the *best* pump for your job!



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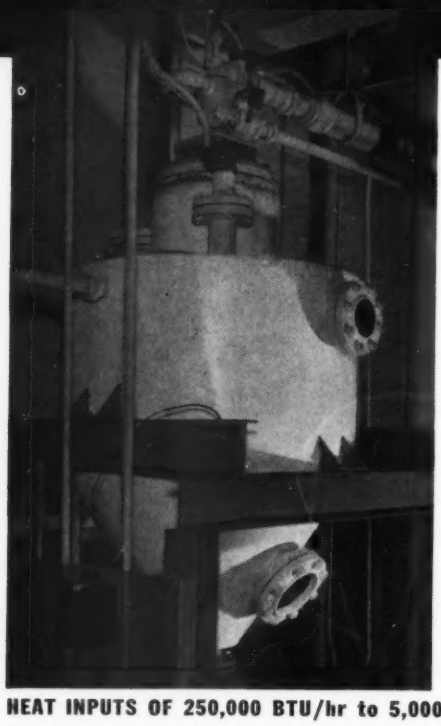
UNIPUMP

IF YOU HAVE PUMPING PROBLEMS, let a WEINMAN PUMP SPECIALIST solve them for you!

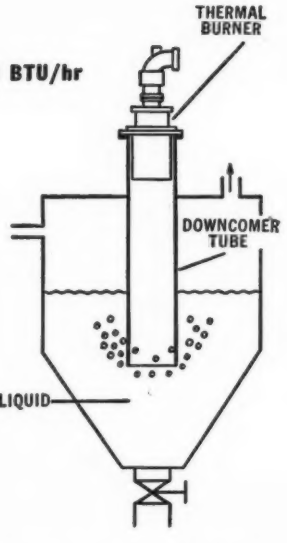
He'll make certain you get the "right" pump for the right job! No matter where you're located, there's a qualified WEINMAN CENTRIFUGAL PUMP SPECIALIST available to lend you a helping hand. Consult the yellow pages of your phone book . . . or write for the name of your nearest representative.

THE **WEINMAN PUMP** MFG. CO.
290 SPRUCE ST. COLUMBUS 8, OHIO

THERMAL
SUBMERGED COMBUSTION



simplicity of design and construction... *plus* extreme compactness



HEAT INPUTS OF 250,000 BTU/hr to 5,000,000 BTU/hr

The high heat release rate of the THERMAL High Velocity burner used in these submerged combustion installations allows the use of a simple downcomer tube through which the products of combustion are discharged beneath the surface of the liquid. This arrangement is possible because combustion is 90% completed within the burner proper. The THERMAL burner is completely separate from the liquid being heated and maintenance, control and accessibility are greatly simplified. Equally simple arrangements are possible with gas, oil or combination fuel.

BROAD RANGE OF APPLICATIONS

Depending upon the material being heated either a metal or refractory downcomer tube may be used. Some of the more common applications are pickling baths, acid concentration, caustic soda concentration, aluminum sulphate concentration, water recarbonization, and glass frit and molten salt heating.

WRITE FOR BULLETIN #110

OTHER THERMAL PRODUCTS & SERVICES → **Gas, Oil & Combination Burners • Air Heaters • Combustion & Heat Transfer Equipment**

THERMAL
Thermal Research & Engineering Corp.

CONSHOHOCKEN • PENNSYLVANIA

REPRESENTATIVES IN PRINCIPAL CITIES

Client, Annand Boone & Lei Architects.

General Hospital. Electrical design. University of Oregon, Portland, Ore. $6,000,000. Client, Lawrence Tucker & Wallmann Architects.

Corvallis High School, Corvallis, Ore. Electrical design. $1,000,000. Client, Annand Boone & Lei Architects.

Powellhurst Elementary School. Electrical design. (Multnomah county), Portland, Ore. $230,000. Client, Annand Boone & Lei Architects.

Youngson Elementary School, Electrical design. Portland, Ore. $270,000. Client, Dukehart & Kinne Architect.

PENNSYLVANIA

Parsons, Brinckerhoff, Hall & Macdonald. Report on proposed rehabilitation of Liberty Tunnels, connecting downtown Pittsburgh with suburbs. Client, Allegheny County Dept. of Public Works.

The Ballinger Co. Architectural plans, contract plans, and specifications for Upper Darby Junior High School to be heated by high temperature hot water. $2,244,000. Client, Upper Darby School Board, Pa.

The Kuljian Corp. Design, engineering, and construction supervision of three-story cellar building. $800,000. Client, Adam Scheidt Brewing Co., Norristown.

Michael Baker, Jr., Inc. Surveys, construction plans, and specifications for battalion headquarters facilities at two NIKE sites in the Pittsburgh Defense Area. $1,000,000. Client, U.S. Army Engineers, Pittsburgh District Office.

Design of L.R. 70 in Allegheny and Butler Counties, six miles of four-lane divided highway on new location. $2,300,000. Client, Pa. Dept. of Hwys.

Design and supervision of construction of Washington, Pa. airport runway paving and lighting. $364,000. Client, Washington County, Pa., Board of County Commissioners.

The Ballinger Co. Phoenixville Area Joint High School for 750 students. $1,700,000 (approx.). Client, Chester County, Pa.

Sauter & Castor. Women's Residence Halls, Pa. State University, State College, Pa. Four buildings, four stories each and dining hall, concrete lift slab construction, associated with A. W. Lookup Co., Philadelphia, Pa. $500,000. Client, Harbeson, Hough, Livingston & Larson, Architects.

RHODE ISLAND

Fred S. Dubin Associates. Carl W. Haffenreffer Residence, Rhode Island. $100,000. Client, architects, Cull, Robinson, & Green.

North Smithfield Rhode Island Junior High School, $300,000. Client, architects, Cull, Robinson & Green.

TEXAS

Mitchell and Hunt. Storm drainage facilities. $600,000. Client, City of San Antonio, Texas.

HOFFMAN'S ENGINEERED SYSTEMS designed to do the tough jobs in industry

STRIKING ADVANCE IN MATERIALS CONVEYING WILL BRING NEW EFFICIENCY, SPEED, SAFETY TO YOUR OPERATIONS!

Things are moving in the materials handling field. Especially since the development of the double-damper valve. This valve already has multiple applications, and fresh ones are being discovered all the time. Some plants use the valve to feed dry materials *into* a conveying system; in other plants it discharges materials *from* a system. All materials passing through the valve are delivered in uniform, measured batches.

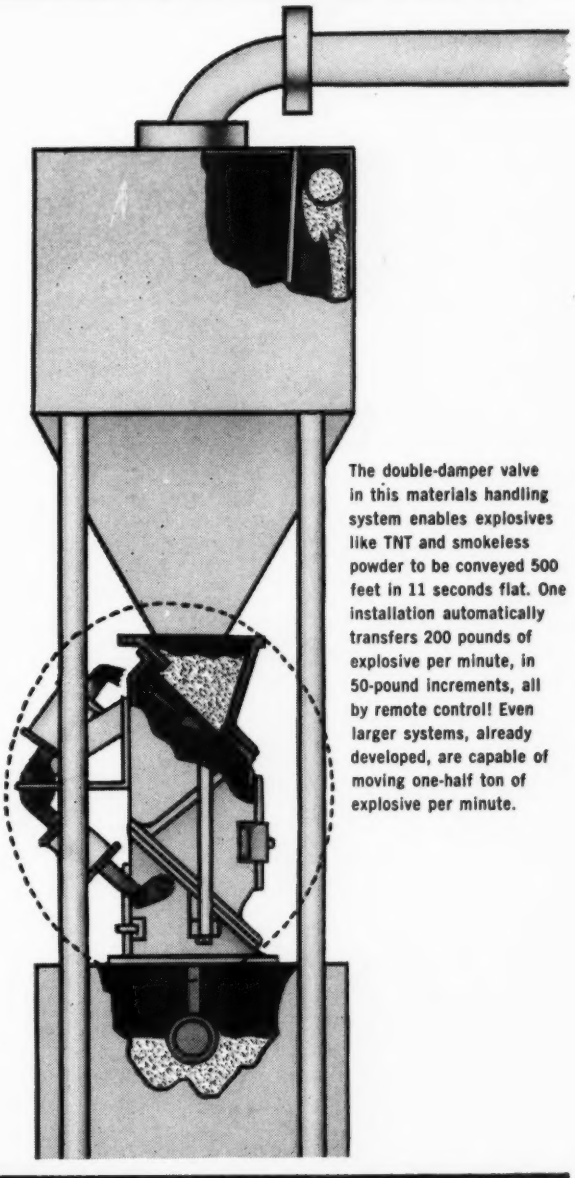
Air appliance engineers had been striving for years to perfect a valve of this kind, which would constitute an effective air-lock between the high-pressure differential inside a pneumatic conveying system and the atmospheric pressure outside. Now they have succeeded. And the number of purposes to which the valve can be put in industrial conveying is enormous.

The double-damper valve represents a new concept in fast, accurate, *safe* conveying. It is now possible—in fact, simple — to move materials that are explosive, fire-hazards or a menace to health, as well as inert materials, because there is no concentration of material and the valve's live rubber seats avoid friction and wear.

The double-damper valve is part of a Hoffman engineered system, another instance of how Hoffman's ingenuity is helping industry achieve the higher standards of safety and efficiency that mean higher output.

Yes, things are moving in the materials handling field, and Hoffman's engineered systems are moving them! Would a materials conveying system speed up operations . . . avoid danger and wastage . . . increase capacity . . . in plants designed by you?

If you think so, or even if you aren't sure, write or call Hoffman, and learn how our engineers will work with you from design through installation of every system.



The double-damper valve in this materials handling system enables explosives like TNT and smokeless powder to be conveyed 500 feet in 11 seconds flat. One installation automatically transfers 200 pounds of explosive per minute, in 50-pound increments, all by remote control! Even larger systems, already developed, are capable of moving one-half ton of explosive per minute.

U.S. HOFFMAN MACHINERY CORP.
AIR APPLIANCE DIVISION
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Machine tool coolant clarifiers—flotation, mechanical and magnetic
Lubricating and insulating oil conditioners, filters and vaporizers
Solvent recovery systems—vacuum stills and filters

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Multistage centrifugal blowers and exhausters
Pneumatic conveying equipment
Industrial vacuum cleaning—portable and stationary systems
Continuous metal strip driers
"Smoothflow" fittings and tubing

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Special pneumatic conveying systems
High-efficiency centrifugal separators
Stationary and portable vacuum-cleaning equipment
Process equipment
Pneumatic systems for radioactive materials

SPECIAL
JERGUSON
WELDING PAD GAGES
are integral part
of this tank

Welding Pad Gages staggered on tank for continuous visibility.

HERE is a special line of gages that weld right to the liquid containing structure, thus becoming an integral part of it. It solves problems where it is impractical for you to use a conventional type gage because of solids in suspension in a liquid, etc.

These Special Gages follow Jerguson Standard Gages in general design and materials, except for the method of attaching. The chamber of the gage consists of a bar steel pad which is welded to the vessel.

Welding Pad Gages are made in both Reflex and Transparent types . . . in all sizes of Jerguson Standard Gages. Pressure ratings are available to your specific requirements. Welding pad may be of any metal desired to withstand corrosive or other conditions.

Write for Data Unit on Welding Pad Gages for complete details. Whatever your gage problems, let Jerguson engineers assist you.

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100 Fellsway, Somerville 45, Mass.
Offices in Major Cities
Jerguson Tress Gage & Valve Co., Ltd., London, Eng.
Pétrole Service, Paris, France

Bechtel Corp. Engineering and construction of addition to alumina plant near Corpus Christi, Texas. $25-30,000,000 (est.). Client, Reynolds Metals Co.

Blum & Guerrero Engineers. Municipal auditorium for Austin, Texas. 500 tons refrigeration, 480 v electrical system. $2,000,000. Client, City of Austin, Texas.

UTAH

Caldwell, Richards & Sorenson. Design of solar evaporating facilities being constructed on the shores of Great Salt Lake in Utah. (First large solar evaporating plant built here in 40 years.) $400,000. Client, Chemical Salt Production Co., Tacoma, Wash.

FOREIGN

Fred S. Dubin Associates. Conference Hall, auditorium, permanent exhibition hall, Berlin, Germany. $3,500,000. Client, U.S. Dept. of State, architect, Hugh Stubbins Associates.

Harza Engineering Co. Hydrological survey of Iraq, joint-venture with Binnie, Deacon and Gourley-London. Client, Government of Iraq.

Development of power in Honduras. Client, Republic of Honduras.

Vitro Corporation of America. Preliminary study contract for a large heavy water and nitrogen fertilizer plant to be built in the Bhakara-Nangal area of North India on the Sutlej River. Client, Government of India.

Michael Baker, Jr., Inc. Completion of highway linking Cambodia's capital with new deep seaport on the Gulf of Siam. $15,000,000. Client, Government of Cambodia.

Daniel, Mann, Johnson & Mendenhall. Architecture-engineering services for advance planning for guided missile support facilities at U. S. Fleet Activities, Japan. $240,000. Client, OICC Bureau of Yards and Docks Contracts, Far East, U. S. Navy.

MISCELLANEOUS

Eugene Herzog & Associates. Air supply system for fluid dynamics testing. $2,500,000. Client, U.S. Air Force.

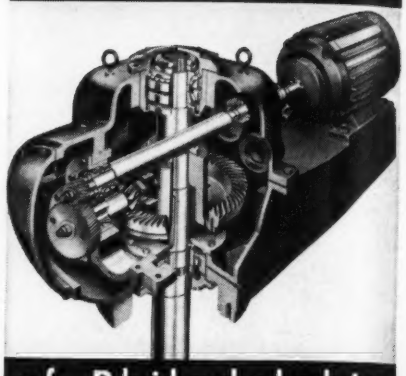
Porter, Urquhart, McCreary & O'Brien. A classified project. $100,000,000. Client, A.E.C.

Wood & DeLapp. Static missile assembly building, captive missile assembly building, missile countermeasures laboratory. $1,500,000. Client, Kenneth S. Clark, Architect, for Corps of Engineers, U.S. Army.

PLEASE REMEMBER

To send us information on your New Projects for listing in this column — name or type of project, location, total estimated cost, and name of the client.

COMPARE
the *Construction*



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FLUID
AGITATORS

Exclusive Low Head Room Design—maximum bearing span with minimum headroom • Helical Change Gear Set, within housing, allows for ready selection of up to 14 standard speeds • Heavy Duty Thrust Bearings permit use of standard units for conditions of high pressure in closed tanks • Large Heavy Duty Output Shafting results in less shaft deflection at stuffing box or mechanical seal, steady operation of long overhung agitator shafts • Heavy Duty Inboard Bearing Support provides extra rigidity resulting in superior gear performance and life • Spiral Bevel Gears of Hardened Steel, accurately lapped for long and quiet operation • Field-proven Dry-Well Construction prevents oil leakage down output shaft • Labyrinth-type seal on input shaft allows effective sealing with minimum friction • . . . Plus a complete Fluid Agitator Engineering Service, backed by over 62 years of experience.

Write for Bulletin A2-55.

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BALTIMORE • CLEVELAND
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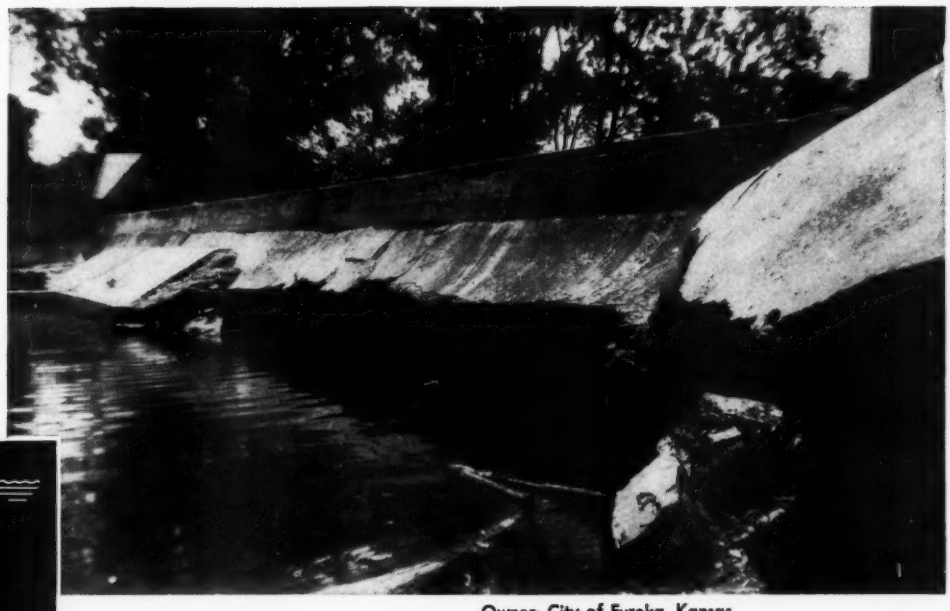
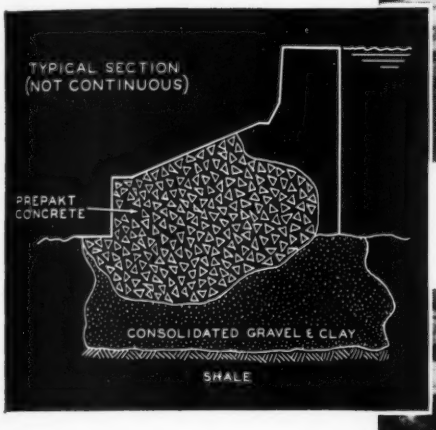
Industrial Gears & Speed Reducers • LimiTorque Valve Controls
Established 1892

BEFORE—Large concrete section broke away from Fall River Dam in 1951 flood. Gravel strata under dam also permitted extensive leakage, serious in drought-ridden area.

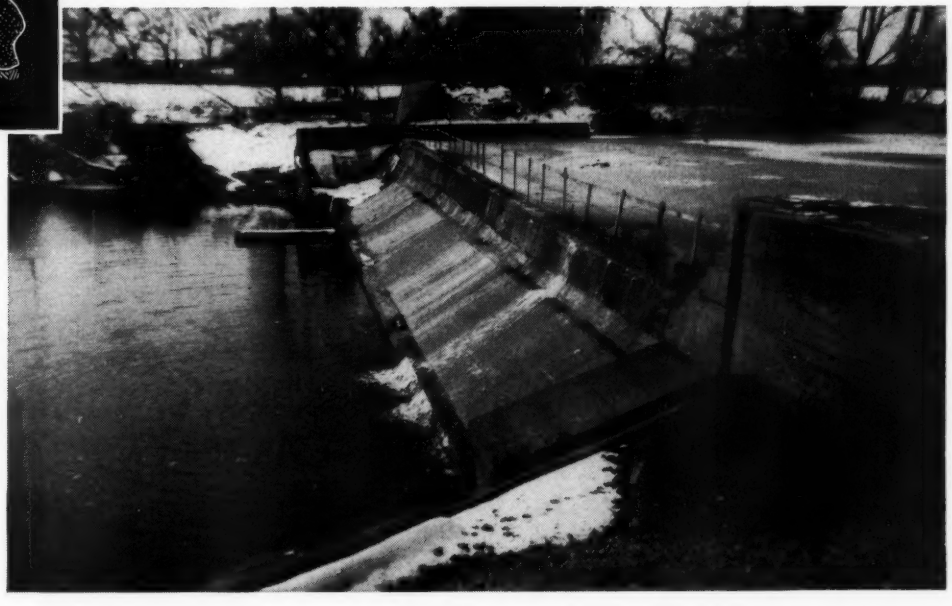


Owner: City of Eureka, Kansas
George E. Jackson, Commissioner of Streets and Utilities



Profile of Fall River Dam

AFTER—Fall River Dam today is better than new. **INTRUSION-PREPAKT** sealed dam and substrata against leakage, then replaced eroded concrete. Repairs avoided costly alternative of new dam.



flood-damaged dam gets new lease on life

Economical INTRUSION-PREPAKT repairs have restored the deteriorated Fall River Dam near Eureka, Kansas, avoiding the expense of a new dam. The 50-year old structure, flood-damaged and leaking badly, was in critical condition.

Leakage was halted by a procedure of drilling, washing and pumping INTRUSION grout to (1) consolidate porous clay and gravel under the dam and (2) fill voids and honeycomb in the dam. Some 6500 cu. ft. of INTRUSION grout sealed the leakage effectively.

Eroded concrete was replaced with PREPAKT concrete, made by consolidating preplaced aggregate with INTRUSION mortar. Some 290 cu. yds. were placed with no dewatering necessary. Dense, impermeable PREPAKT concrete has a strong, tight bond to existing concrete and superior resistance to cyclic freezing and thawing. It can be made underwater as well as in the dry.

INTRUSION-PREPAKT specializes in the construction and maintenance of heavy concrete structures and foundations; maintains a complete field construction organization; provides engineering service. For information, write: INTRUSION-PREPAKT, Inc., Room 779-K, Union Commerce Bldg., Cleveland 14, Ohio. In Canada: INTRUSION-PREPAKT, Inc., 159 Bay Street, Toronto, Ontario.

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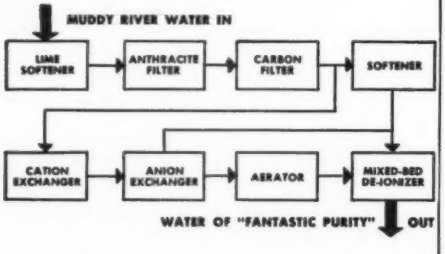
ILLCO-WAY
ionXchange

HOW TO
UN-MUDDY
THE WATERS



This block diagram shows a typical arrangement for a power company steam plant that must draw its boiler feed water from a nearby muddy river. The Lime Softener takes out suspended solids, turbidity, alkalinity, and organic matter; the Anthracite Filter removes any remaining turbidity; the Carbon Filter removes the chlorine; the Softener provides process water; the Cation and Anion Exchangers remove the dissolved solids such as carbonates, sulfates, and chlorides; the Aerator takes out most of the CO_2; and the Mixed-Bed De-Ionizer eliminates the remaining 4 or 5 ppm of solids, silica, and 5 ppm of CO_2 — to produce water of "fantastic purity."

ILLCO-WAY PIONEERS IN
PRACTICAL EXPERIENCE

Illinois Water Treatment Company designs and builds *complete, practical, workable systems* such as that shown above — to operate economically on a cost-reducing basis. This work is based on a wealth of practical knowledge gained through constant experience in the specialized field of ion-exchange, starting from the time that the first workable resins became available.
Remember ILLCO-WAY—foremost in the field of ionXchange.

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Books

TO ORDER BOOKS

As a readers' service, CONSULTING ENGINEER will order reviewed books or any other technical volumes you need. In ordering books, give title, author, and publisher and enclose check. We will also suggest titles of technical books and order for you at regular publishers' prices.

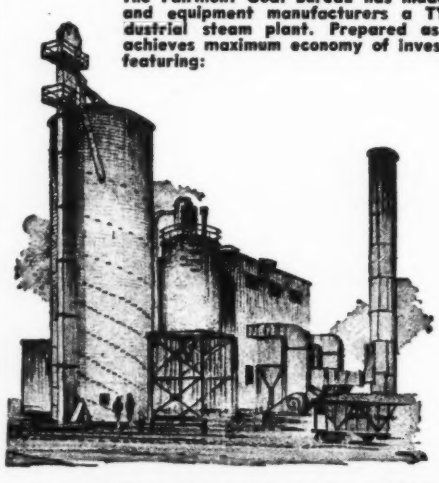
THE TECHNOLOGY OF CONCRETE AND CEMENT, Vol. 1, by Robert F. Blanks and Henry L. Kennedy; John Wiley & Sons, Inc.; 422 pp.; $11.00.

Reviewed by Gilbert H. Howe
Lyle, Bissett, Charles & Wolff

Concrete materials are covered in the first volume of a two-volume series. Scientific literature on this subject is voluminous and scattered throughout many proceedings, journals, and other texts; so much so that it is difficult and sometimes practically impossible to find needed information. The situation is acute when technical libraries are inaccessible. The book answers the need for

Modern Design *for the*
MODERN COAL

The Fairmont Coal Bureau has made available to consulting engineers and equipment manufacturers a TYPICAL DESIGN for the small industrial steam plant. Prepared as a guide to good engineering it achieves maximum economy of investment and engineering costs, while featuring:



- Fuel flexibility
- High efficiency
- Low fuel costs
- Minimum labor requirements
- Cleanliness, Automaticity, Reliability

Fairmont Pittsburgh Seam Coal is the MODERN COAL. Enormous reserves and inherently favorable mining conditions guarantee ample supply and low production cost. Modern mining and preparation facilities assure uniform quality.

Fairmont Coal Bureau engineers are freely available to help you solve fuel and combustion problems. Write for Technical Reference Bulletins and other valuable publications.

FAIRMONT COAL BUREAU
Dept. CE, 122 East 42nd St., New York 17, N. Y.

a single source of information.

The authors have compiled many basic, currently known facts in one volume. By use of graphs and tables the subject matter is covered both qualitatively and quantitatively. This book will help the average consulting engineer to make better professional decisions, particularly where it is necessary to decide if satisfactory concrete can be made using local aggregates.

The book has three main parts: Part I, Introductory; Part II, Cementing Materials and Admixtures; Part III, Concrete Aggregates. There are many references: the chapter on Pozzolanic Cements alone has 81.

The information on Portland cement is complete and includes a detailed account of how it is manufactured. Other hydraulic cements such as natural, masonry, and oil well cements are classified and their uses explained. The chapter on additions and admixtures evaluates and explains the practical application of air entrainment.

The part on concrete aggregates emphasizes that aggregate is not inert, but has physical, chemical, and thermal activity, which may have considerable effect on the finished concrete. In this connection, a table on the characteristics of the most important rock types is included in the chapter, "Geology on Petrography of Concrete Aggregates."

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SIGHT FLOW INDICATORS

"See What Goes On Inside"

For insertion into pipe

FOR EVERY APPLICATION

BRONZE, IRON, STEEL, STAINLESS STEEL

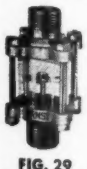

FIG. 29 Cylinder with Impeller

FIG. 17-28 Cylinder

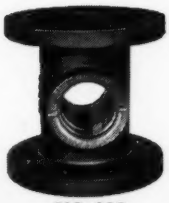

FIG. 215 Flanged

FIG. E-57 Double Window

FIG. 212 Visibility Welding Neck or Screw

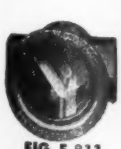

FIG. E-811 Flapper

FIG. E-1810 Rotating Wheel Type

All sizes up to 6" *Send for Catalog*

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LIVINGSTON, N. J.

INDUSTRIAL designs and builds COMPLETE Waste Treatment Systems

Why most waste treatment problems cannot be solved with standard equipment

There can be no true economy in either purchase or operation unless the unit takes advantage of all factors inherent in the process itself. For instance . . . Industrial has built a number of systems where waste chemicals from one part of a process are used to neutralize wastes from other sections . . . an obvious saving in equipment and chemicals . . . due to thorough preliminary analysis.

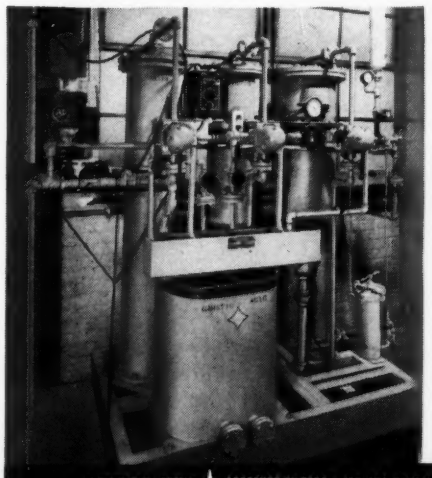
Only for the simplest kinds of waste disposal or recovery can you buy cataloged equipment with any real assurance of efficient operation.

Industrial builds equipment . . . sells engineering

When you consult an Industrial engineer, you won't get a sales talk on a line of standard equipment . . . (even tho Industrial makes many kinds of processing equipment in hundreds of model sizes) . . . you'll get a full analysis of your problem and a design incorporating the most efficient apparatus modern technology can provide. Industrial will build, buy or adapt equipment to assemble the system most suitable for your exact needs.

One company responsibility is important...

there are no loose ends on an Industrial installation . . . no *recommended* auxiliary parts . . . no subsidiary engineering problems left for you to solve. Industrial stands squarely behind the operating efficiency of each complete system.



Waste treatment can be profitable . . . This unit paid for itself in a few months

This ion-exchange system at the Sunbeam Corporation, Chicago, removes sulfuric and boric acids from plating rinse wastes. It recovers gold and nickel salts and continuously returns pure water to the rinse system. It not only yields substantial savings in metal and water but also improves the quality of plating.

Write or call Industrial for free solution analysis and cost estimates.

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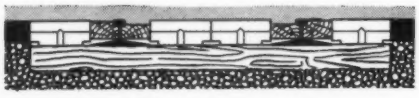

to smooth, low-cost permanent crossings

Stop unnecessary damage to industrial cars, trucks and cargo with smooth, durable Permacrete pre-cast concrete Crossing Slabs. Time, weather and high-impact traffic play havoc with ordinary railroad crossing materials but Permacrete slabs provide the maximum in strength and safety, coupled with low initial cost and no down time for repairs. Don't settle for less . . . Get Positive Performance with Permacrete.

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City_____ State_____

The book is written on the premise that regardless of technical complexity good concrete can be made if a few basic principles are observed. The book is recommended to anyone who needs authentic, specific, and understandable information on Portland cement and concrete aggregates.

ALSO AVAILABLE

THE MMH MATERIALS HANDLING MANUAL, edited by Val Laughner; Boston Publishing Co., Inc.; 384 pp.; $5.00.

This is the first volume of a basic reference and working text. It covers all phases of material handling and is written from an engineering standpoint, with emphasis on methods as well as applications. It is divided into seven sections: Over-all Problems of Handling; Plant Layout and Operation; Warehousing and Indoor Storage; Outdoor Storage and Yard Handling; Pallets, Unit Loads, and Packaging; Shipping and Receiving; and Handling Special Shapes.

•

ESL BIBLIOGRAPHY No. 11, The Engineering Societies Library; $2.00.

This is a revised list of annotated references to selected books and periodical articles published from 1924 to 1955. They cover theory, design, and construction of machinery foundations; specific problems such as heavy machinery foundations on unstable soils; and vibration as related to foundations for hammers, oil engines, electrical machinery, turbines, steam engines, compressors, machine tools, pumps, and presses.

•

AGA FLOW CONSTANTS, The Foxboro Co.; $10.00.

Compiled as a supplement to *Principles and Practice of Flow Meter Engineering,* by L. K. Spink, this manual contains 77,811 separate flow calculations evaluated to six figures. Use of the table will save time in computing odd orifice sizes, odd pipe sizes, round-number coefficients, and orifices for direct-reading gas meters where the line pressure is held constant.

•

ENGINEERING STANDARDS MULTIPLE V-BELT DRIVES, Rubber Manufacturers' Association, Inc. and Multiple V-Belt Drive & Mechanical Power Transmission Association; 24 pp.; $1.00.

This is a revised edition of the 1951 standard including revised standards taking into account technological improvements in V-belts that have resulted in greater belt strength with attendant higher horsepower ratings.

HOW TO GET AROUND TIME and COST FACTORS

in Protecting Pipe Against Corrosion

When you are faced with the problem of protecting piping underground in highly corrosive soils, a high quality coal tar coating such as called for in AWWA Specifications C-203 and C-204 is normally hot applied at a pipe coating mill. However, in many cases, the volume of pipe does not warrant this expense or the coating mill is too far away to justify the time involved.

That's WHEN Engineers Specify TAPECOAT®

. . . the practical alternate hot-applied coal tar coating in handy tape form

Because TAPECOAT provides a coal tar coating equivalent in long-life protection to hot-applied coating at the mill, engineers are specifying this quality alternate material where time and cost factors preclude mill application.

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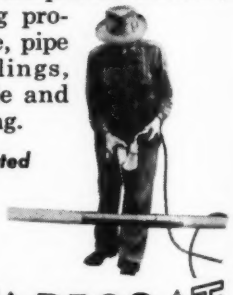

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May 2-4	American Institute of Electrical Engineers	North Eastern District Meeting	Sheraton Hotel Rochester, N. Y.
May 6-9	American Institute of Chemical Engineers	Meeting	Roosevelt Hotel New Orleans, La.
May 15-16	Armour Research Foundation of Illinois Institute of Technology and *Nucleonics* magazine	Industrial Nuclear Technology Conference	Museum of Science and Industry and Shoreland Hotel Chicago, Ill.
May 16-18	Prestressed Concrete Institute	2nd Annual Convention	Hollywood Beach Hotel Hollywood, Fla.
May 17-19	New York State Society of Professional Engineers	30th Engineering Industries Exposition and Annual Convention	Statler Hotel New York, N.Y.

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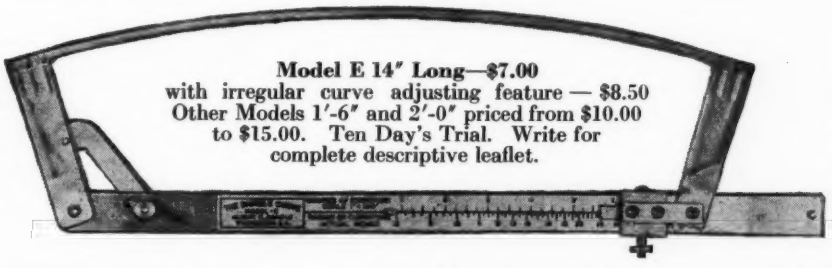

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